REPORT TO CONGRESS

on the activities of the

DoD Office of Technology Transition

January 2000
This report responds to 10 USC 2515

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The Office of the Secretary of Defense
Deputy Under Secretary of Defense for Science and Technology
Office of Technology Transition

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EXECUTIVE SUMMARY

The Office of Technology Transition (OTT) was created by the Secretary of Defense in response to 10 U.S.C. § 2515, to serve as a focal point for the domestic technology transfer activities of the Department of Defense. This report, required by legislation, summarizes OTT accomplishments for FY 99.

OTT has played an active role in development and/or execution of technology transfer programs; in development of technology/dual use technology policy; and in coordination of the collection and dissemination of scientific and technical information in support of technology transfer. Specific activities conducted in FY 99 are discussed in this report and its appendices. In summary, this office:

- Provided leadership and focus for the DoD Technology Transfer Program
  - The results of a study on the value of CRADAs to DoD was published in April 1999 and are described in section A of this report. In addition, to further the awareness and use of technology transfer mechanisms, information on mechanisms and policy was submitted for incorporation into the Defense Acquisition Deskbook.
  - The DoD Directive 5535.3, "DoD Domestic Technology Transfer Program," was signed on May 21, 1999. This Directive institutionalizes policy on domestic technology transfer and stresses the importance of technology transfer as a key activity within DoD. The Directive's accompanying Instruction 5535.8, "DoD Domestic Technology Transfer Program," was also issued in May 1999 and identifies specific procedures for technology transfer implementation.
  - Ten DoD representatives served in elected and non-elected positions within the Federal Laboratory Consortium for Technology Transfer (FLC) organizational structure and DoD organizations provided $642,136.00 in financial support to the FLC. Additionally, five teams of DoD scientists and engineers won FLC Annual Awards for Excellence in Technology Transfer which recognize laboratory employees who have done outstanding work in the process of transferring lab-developed technology to the private sector.
- Managed the DoD Dual Use Science and Technology Program
  - In the first three years, 218 projects have been initiated with a total value of over $700 million
- Managed the Office of the Secretary of Defense, Deputy Under Secretary of Defense (Science & Technology) Small Business Innovation Research (OSD DUSD (S&T) SBIR) Program
  - The objectives of the OSD DUSD(S&T) SBIR Program include stimulating technological innovation, strengthening the role of small business in meeting DoD dual use research and development needs, fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and increasing technology transfer through commercial application of DoD-supported research and development results.
  - The FY 00 Program, funded at $20M, will fund topics in two technology areas: Cognitive Readiness and Smart Sensor Web. These are two priority technology areas in the investment planning strategy of DUSD(S&T).

- Provided oversight for the DoD Manufacturing Technology Program
  - •• Sponsored a conference attended by 200 S&T managers from DoD and industry to share affordability best practices and lessons learned. The session included a panel session with each of the Service Acquisition Executives.
  - •• Worked with each Service to sponsor separate workshops focused on improving the process for transitioning the results of 6.3 advanced technology development efforts into acquisition.
  - •• Published a handbook for S&T managers for use during formulation of affordability programs.
  - •• The annual Defense Manufacturing Conference continues to be a premier activity for networking and sharing the results of ongoing and completed manufacturing programs across the DoD, industry, and other government agencies. The 1999 conference was held in Miami, FL. Over 800 leaders from government, industry, and academia attended.
- Directed the collection and dissemination of technology transfer information by the Defense Technical Information Center (DTIC).
  - •• As of December 31, 1999, the Defense Technology Transfer Information System (DTTIS) contained project information on 3,265 DoD Technology Transfer Activities, including 1,671 active Cooperative Research and Development Transfer Agreements (CRADAs) and 174 active Patent License Agreements.
- Coordinated the Independent Research and Development (IR&D) Program
  - •• DoD IR&D policy is promulgated in DoD Instruction 3204.1, "Independent Research and Development (IR&D) and Bid and Proposal (B&P) Program." In May 1999, DoD issued this DoD Instruction as a revised DoD Directive to bring policy guidance in line with current law and program administration.
- Provided direction and oversight for the Defense Production Act Title III Program
  - •• The Title III Program is unique among DoD programs since it is the only program specifically aimed at establishing or expanding domestic production capacity. During 1999, six projects were active, including one new start; three pending initiation; and two completed. The cumulative value of all active Title III projects is approximately $76 million.
- Provided direction and oversight for the Commercial Operations and Support Savings Initiative (COSSI)
  - •• COSSI has just completed the third competition (FY 00). Out of 20 proposals, 11 were selected for award.
  - •• Thirty Stage I projects were selected in the initial COSSI solicitation issued in FY 97. During FY 99, two of these projects, DRA and Mini-MUTES, transitioned into production.

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I. BACKGROUND

Section 2515 of title 10, United States Code (Appendix A) - directs that "The Secretary of Defense shall establish within the Office of the Secretary of Defense an Office of Technology Transition." It further directs that the head of the office will ensure that the office will monitor research and development (R&D) activities of the Department of Defense; identify R&D activities that result in technological advances that have potential for nondefense commercial applications; serve as a clearinghouse for, coordinate, and actively facilitate the transfer of such technologies and technological advancements to the private sector; conduct its activities in consultation and coordination with the Department of Energy and the Department of Commerce; and provide private firms with assistance in resolving problems related to technology transfer. It also directs the Secretary of Defense to submit to the Committees on Armed Services, and Appropriations of the Senate and the House of Representatives an annual report on the activities of the Office at the same time the budget is submitted to Congress by the President. This report responds to that requirement and is the seventh annual report.

On April 30, 1999, Dr. Lance A. Davis resigned as Deputy Director for Defense Research and Engineering (Laboratory Management/Technology Transition) at which time Mr. John B. Todaro assumed his responsibilities as Director, Office of Technology Transition.

In FY 98, the Defense Technical Information Center was moved into the Defense Information Systems Agency for management, support, and overall guidance. However, as the repository of DoD S&T information, it continues to support technology transfer functions through maintenance of websites, databases, information analysis centers, and other sources of technical information. It is anticipated this support will continue to assist in monitoring R&D activities and facilitating the transfer of technology.

In keeping with the integrated planning and process team concept throughout the Department, the activities of the Office are conducted with the consultation, support, and active participation of personnel in the Military Departments and Defense Agencies.

II. INTRODUCTION

The Department of Defense established the Office of Technology Transition in response to congressional direction to ensure that technology developed for national security purposes is integrated into the private sector of the United States in order to enhance the national technology and industrial base, reinvestment, and conversion activities. We believe the underlying assumption is that the Defense Laboratories and Defense Agencies are technological powerhouses whose efforts can be brought to bear on domestic commercial technology opportunities at one and the same time that defense critical needs are being addressed. The technological investments made by the DoD to develop agile, smart weapons systems, training systems, trauma care, etc, have caused, in many cases, an economic impact far larger than that suggested by the program budgets alone, therefore enhancing the nation's industrial competitiveness or otherwise improving the Nation's quality of life.

DoD is working to develop a broad Technology Transfer Program that encompasses the Department as a whole. We are using a common sense approach to this program to break down barriers preventing us from commercializing appropriate technology. We are also trying to expand our horizons to use what is readily available from the commercial sector. By leveraging available resources, we can expand and enhance our capabilities both within our weapons systems and within our processes for making the transfer of technology possible. In doing so, it is recognized that the Nation will achieve an improved return on its national security technology investment and the Nation's industrial competitiveness will be improved. In every case, however, the essential goal is to achieve technically superior, affordable Defense systems; those technology efforts that contribute to international competitiveness, but have no defense relevance, are the proper province of other Federal agencies and/or private industry.

The DoD Technology Transfer Program is a dynamic program that we anticipate will contribute to more affordable Defense systems in the future.

III. OFFICE OF TECHNOLOGY TRANSITION ACTIVITIES

- Defense Technology Transfer Management & Oversight
- Dual Use Science and Technology Program
- Small Business Innovation Research
- Manufacturing Technology Program
- Defense Technical Information Center
- Independent Research and Development
- Commercial Operations and Support Savings Initiative
- Title III of the Defense Production Act

A. DEFENSE TECHNOLOGY TRANSFER MANAGEMENT AND OVERSIGHT

The Defense Department operates a decentralized technology transfer program. The Military Departments are recognized as separate agencies for program implementation. The objective is to transfer technology between the public and private sectors. The information below is intended to look at the ongoing activities helping us achieve this objective.

Communication is necessary within and between Defense Department technology transfer activities as well as with potential and existing partners in the private sector. The Defense Technology Transfer Working Group (DTTWG) is a key element in communication within the DoD. Other tools being used to enhance communication and understanding of technology transfer are the Federal Laboratory Consortium for Technology Transfer (FLC), DoD Workshops such as the Technology Transfer Integrated Planning Team (TTIPT), the Defense Technology Transfer Information System (DTTIS), websites such as TechTRANSIT, policy such as the new DoD Directive and Instruction on Technology Transfer, and other meetings and activities. The results of a study on the value of CRADAs to DoD was published in April 1999. To further the awareness and use of technology transfer mechanisms, information on mechanisms and policy was submitted for incorporation into the Defense Acquisition Deskbook.

DoD Technology Transfer Policy

The DoD Directive 5535.3, "DoD Domestic Technology Transfer Program," was signed on May 21, 1999. This Directive institutionalizes policy on domestic technology transfer and stresses the importance of technology transfer as a key activity within DoD. The Directive's accompanying Instruction 5535.8, "DoD Domestic Technology Transfer Program," was also issued in May 1999 and identifies specific procedures for technology transfer implementation. These two documents ensure technology transfer activities are integral elements of DoD's pursuit of its national security mission and have a high priority role in our programs.

Defense Technology Transfer Working Group (DTTWG)

The DTTWG was established in 1994 and is comprised of representatives from each of the Military Departments and most of the Defense Agencies. This group meets monthly to review technology transfer issues requiring either consistent policy or approach from a joint DoD perspective. The issues for FY 99 included:

- implementation of the new Directive and Instruction on the DoD Domestic Technology Transfer Program
- review and comment on the Department of Commerce's Biennial Report to Congress on Technology Transfer
- management of unplanned funding for DoD technology transfer activities (MSU TechLink and Commercialization of Technology to Lower Defense Costs)
- policy for donation of research equipment under 15 USC 3710(i), 15 USC 3710a(b), and 10 USC 2194
- patent rights under CRADAs when in-house contractor participates as the "government" contribution
- use of Partnership Intermediaries to assist in transferring technology
- Intellectual Property Management Information System (IPMIS) developed by the Navy and modified for the Air Force with potential use by the Army. (Further information on the IPMIS can be found in Appendix C)

Technology Transfer Mechanisms

The DoD is using a variety of technology transfer mechanisms to enable spin-off, spin-on, and dual use of technologies. These mechanisms include Cooperative Research and Development Agreements (CRADAs), Patent License Agreements (PLAs), Educational Partnership Agreements (EPAs), and programs discussed in other sections of this report (SBIR, DU S&T, COSSI, ManTech). We had 1638 active CRADAs as of October 14, 1999, providing the ability to work with the private sector in a manner that is unique to this mechanism. We appreciate Congress' intent to transfer technology to the private sector when it passed legislation enabling us to work in a collaborative manner with industry via CRADAs. As elaborated later in this section, CRADAs have proven beneficial to both the DoD as well as private industry.

PLAs enable DoD to license technology when that is the best way to get technology used by the private sector. As of October 1, 1999, we had 260 active licenses generating $1.5M in royalty income and allowing DoD-developed technologies to be used by the private sector. DoD paid about $1.5M to the Patent and Trademark Office for fees associated with obtaining and maintaining patents.

Within DoD, the three Services have been emphasizing the use of Educational Partnership Agreements (EPA). DoD has a significant number of formal EPAs with universities and community colleges as well as local public school districts (i.e., the Air Force has over 100 EPAs). The EPA, as defined under 10 U.S.C. 2194 for DoD, is a formal agreement/ mechanism between a laboratory and an educational institution to transfer and/or enhance technology applications; provide technical assistance; exchange personnel; and loan/donate educationally useful laboratory equipment for all levels of education (pre-kindergarten and up).

DoD Technology Transfer Integrated Planning Team (TTIPT) Workshop

The DoD TTIPT Workshop was held for the fourth time in November 1999 and hosted by the Army. 100 technology transfer professionals gathered to discuss joint projects, best practices, lessons learned, and to hear about technology transfer successes. Each Service provided an update on its technology transfer program implementation, 4 of the Partnership Intermediaries provided information on how they are helping to transfer technology in their local areas, and information on other DoD programs with potential leverage for technology transfer were highlighted. A training session on developing business plans for transferring technology at the local laboratories was provided. Success stories highlighting how the successes were achieved were provided for: Semiconductors, National Automotive Center, Chemical Feedstock Technologies, Manufacturing Technology Curriculum Enhancement, and Smart Antennas. Additionally, roundtable discussions were held on international CRADAs and issues, best practices in marketing patents/technology, and royalty rate estimation.

Federal Laboratory Consortium for Technology Transfer (FLC)

The Military Departments and Defense Agencies have been participating in the Federal Laboratory Consortium for Technology Transfer (FLC) through financial support (see Table 1) and participation in meetings by their technology transfer focal points, serving as committee chairs, and actively supporting interagency laboratory projects. The FLC provides an opportunity to share information with other Federal agency technology transfer professionals and learn about methods employed in other agencies that could help DoD. The FLC also provides a forum for joint work efforts and consolidation of activities. The FY 99 FLC National Meeting, held in the spring, provided an opportunity for DoD to hold its fifth joint

session bringing the Military Departments and Defense Agency representatives together for an information sharing session.

FY 99 DoD Support to FLC

Navy	$	252,360.00
Army	$	164,888.00
Air Force	$	109,624.00
BMDO	$	27,976.00
DoD HQ	$	39,928.00
DARPA	$	24,288.00
Joint Chiefs	$	5,560.00
Defense Special Weapons Agency	$	5,320.00
Defense Information Systems	$	4,304.00
US Special Operations	$	3,688.00
Defense Logistics Agency	$	2,608.00
Operations Test & Evaluation	$	1,592.00
Total	**$**	**642,136.00**

Source: National Institute of Standards and Technology

FLC Award Winners

The FLC Annual Awards for Excellence in Technology Transfer recognize laboratory employees who have done outstanding work in the process of transferring lab-developed technology. Nominations are made by the laboratory representatives and are judged by a panel of experts in the field of technology transfer. The 1999 Department of Defense winners are:

- Jack Briggs, Michelle Richardson, and Dr. Andre Senecal of the U.S. Army Soldier and Biological Chemical Command (SBCCOM), Natick Soldier Center (NSC), for the development of military rations that look freshly prepared yet can be kept at room temperature for up to three years;

- Dr. Mark Spano and Dr. Visarath In of the Naval Surface Warfare Center, Carderock Division, for the application of chaos control techniques to human biological systems—cardiac fibrilation and epileptiform behavior in the brain;

- Chris Bozada, Charles Cerny, Greg DeSalvo, Ross Dettmer, Jack Ebel, Tom Jenkins, Jim Gillespie, Kenichi Nakano, 1Lt. Carl Pettiford, Tony Quach, Jim Sewell, G. David Via and 1Lt. Ryan Welch of the U.S. Air Force Research Laboratory (AFRL), for the transfer of AFRL's patented thermally-shunted heterojunction bipolar transistor technology (TSHBT). The TSHBT is an electronic device that has state-of-the-art performance for microwave power amplification. It allows large power devices to be made smaller with less heat dissipation, saving space and energy;

- Dr Ranganathan Shashidar of the Naval Research Laboratory (NRL), for the development of novel liquid crystal displays (LCDs) and design of plastic substrates for LCDs that offer numerous commercial applications of the technologies which include flat panel displays of all kinds;

- Joseph Gottschlich of the U.S. Air Force Research Laboratory, Propulsion Directorate, for the transfer of a performance-enhancing refrigerant additive (QwikBoost) to commercial products which will reduce heating and cooling costs.

More detailed summaries of these technology transfer awards can be found in Appendix C.

DoD Representatives to the FLC

DoD representatives serve in both elected and nonelected positions with the FLC. These leadership functions facilitate sharing of information with other Federal departments and agencies and contribute to specific technology transfer activities. The following DoD personnel hold positions in the FLC:

FLC Position	Name/Organization
FLC Vice Chair Chair, Planning and Policy Committee	David Appler, DTIC
Chair, Awards Committee	Sue Ibrahim, Army Yuma Proving Ground
Co-Chair, Legal Issues Committee	David Spevack, Office of Naval Research
Chair, Education Committee	Linda Jenkins, Naval Research Laboratory, Stennis Space Center
Chair, Southeast Region	Ed Linsenmeyer, Naval Surface Warfare Center, Coastal Systems Station
Chair, Program Committee	Norma Cammarrata, Army Research Laboratory
Chair, Training Committee Co-Chair, Mid-Atlantic Region	John Griffin, Army Topographic Engineering Center
Chair, Information Systems Committee	Michael Rausa, Army Research Laboratory (Aberdeen)
Co-Chair, Mid-Atlantic Region	Richard Dimmick, Army Research Laboratory (Aberdeen)
Chair, Far West Region	Michael Sullivan, Naval Air Warfare Center, Weapons Division, Point Mugu

In addition to the above positions, Mr. John Todaro, Director, Office of Technology Transition, Office of the Deputy Under Secretary of Defense for Science and Technology and Mr. David Rossi, Department Head, Industrial Programs, Office of Naval Research are currently serving on the National Advisor's Board to the FLC.

Web Sites

New information of interest to the technology transfer community is continuously posted on DoD's TechTRANSIT web site. The TechTRANSIT web site is the gateway to DoD technologies promoting partnering opportunities between the private sector and Defense laboratories. Features available on TechTRANSIT include the ability to access patented DoD technologies available for licensing, a DoD laboratory web site search capability, and information on nontraditional acquisition mechanisms available for use in partnering with DoD. Features of the Month include reports such as "Foreign Participation in Cooperative Research and Development Agreements (CRADAs)" and "DoD Cooperative R&D Agreements: Value Added to the Mission". Updated information is also available on how to use and submit applications to the Laboratory Reimbursement Fund; a fund that provides critical funding to DoD laboratories to further develop environmentally sound technologies for commercialization. The site address is www.dtic.mil/techtransit.

Defense Technology Transfer Information System (DTTIS)

DTIC maintains the DTTIS in cooperation with the Military and Defense agencies. As of December 31, 1999, the DTTIS contained project information on 3,265 DoD Technology Transfer Activities, including 1,671 active CRADAs and 174 active PLAs. Approximately 100 Technology Transfer professionals are registered to use the DTTIS secure World Wide Web site to view and analyze T2 data. 1999 input into the DTTIS included 476 new records and 1578 modifications.

Commercialization of Technologies to Lower Defense Costs Initiative

The Congress provided funding in the Army's Environmental Quality Technology budget line for this program in FY 98, FY 99, and FY 00. The objective of this program is to lower U.S. Defense procurement costs by promoting the commercialization of Federal laboratory technologies which can assist in resolving environmental quality concerns. A portion of this funding has been reserved for the Laboratory Reimbursement Fund (LRF) to support transfer of environmental technologies into production for use by both the military and commercial sectors. Several DoD laboratories have begun working with private sector partners to ensure their technologies can be commercialized. Thus far, $1M has been made available through the LRF with about half going to DoD activities.

Interagency Working Group on Technology Transfer (IAWG/TT)

The three Military Services and DoD participate with the other Federal Agencies on the IAWG/TT chaired by the Department of Commerce. This working group has looked at technology transfer implementation in the various departments, how it varies based on Agency mission, and what we can learn from each other to improve our programs. It has also reviewed international partners in CRADAs, when they should be allowed, and how to assess potential concerns arising in these instances. The Department of Commerce will be issuing its Biennial report on Technology Transfer in early spring of 2000 and will highlight other efforts of the IAWG/TT.

Partnership Intermediaries

Partnership Intermediaries (PIs) can be a contract or a Memorandum of Understanding with agencies of state or local governments or other entities chartered and/or funded by state or local government. Entities serve as intermediaries in performing services for the laboratory that increase the likelihood of success in conduct of cooperative or joint activities for the laboratory with small business firms. PIs provide the ability to leverage local educational resources, as well as state and local governments which appropriate more money than the Federal government in terms of technology based economic development. PIs are agencies for state or local government or a nonprofit entity assisting small businesses, thus enhancing the small business ability to participate in government projects with technology transfer. Five PIs are highlighted below.

The Federal Technology Center **(http://www.theFTC.com)**

The Federal Technology Center (FTC), North Highlands, California is the Partnership Intermediary for the Defense Microelectronics Activity (DMEA), a Department of Defense applied engineering organization in Sacramento, CA. The FTC assists DMEA in the development of technology related partnerships and small business programs.

As an example, CRADAs were signed with Sanders, a Lockheed Martin Company of Nashua, New Hampshire and with Austin Semiconductor, Incorporated (ASI) of Austin,

Texas. The Lockheed Martin agreement focuses on microelectronics and microelectronics-based systems design, development and fabrication of devices and systems for solutions to diminishing manufacturing sources and material shortages. The agreement provides the Lockheed Martin Corporation access to the vast knowledge base and tools that DMEA uses in dealing with the obsolescence issues facing the Department of Defense. The ASI agreement focuses on gamma irradiation testing of electro-optic/fiber-optic systems and electronic device manufacture, test, and failure analysis. Both of these agreements are intended to support the DoD's initiatives furthering the use of commercial-off-the-shelf components in fielded military systems and solving problems with diminishing manufacturing sources. Results of these partnerships will enhance timely application of commercial microelectronic technologies into military systems at reduced cost and risk. In addition, other CRADAs are in development.

The FTC is also assisting DMEA to establish educational partnership agreements with local colleges and universities that have electronic engineering programs. The agreements are designed to enhance the college or university electronic engineering programs while providing recruiting opportunities for DMEA.

The FTC assists DMEA's small business program by providing training and hands-on assistance to small businesses interested in contracting or partnering with DMEA. Small business support includes DoD Central Contractor Registration, DMEA vendor registration, General Service Administration multiple award schedules, and other contracting assistance as required. Over 30 small businesses have been trained or assisted over the past year.

MSU TechLink (http://techlink.msu.montana.edu/)

TechLink
The MSU TechLink Center

The TechLink Center at Montana State University and Edwards Air Force Base have signed a two-year Memorandum of Understanding to implement a new technology transfer and commercialization program. This new program, called TechLink, will focus on assisting all DoD laboratories in their technology transfer efforts in the Northwest United States. TechLink will bridge the gap between the needs of regional businesses and industries and the technology-related resources of Federal laboratories. Benefits to DoD laboratories include increases in the numbers of CRADAs and licenses representing technology transfer taking place. TechLink efforts are aimed at important regional industries, including agriculture, forest and wood products, and mining, as well as the emerging high tech sectors of environmental technologies, electronics, information technology, photonics, and biomedical technologies. TechLink's efforts will also support DoD's Dual Use and SBIR objectives.

TechLink has already developed a successful track record for linking regional businesses and industries with the technology and know-how available from NASA. Now, with DoD as a client, TechLink has the opportunity to develop mutually beneficial relationships between DoD laboratories and companies in the Northwest.

New Mexico Tech

The Air Force and the State of New Mexico has had a formal partnership agreement in technology transfer for over sixteen years. Initially the agreement was through the New Mexico State Economic Development Department, however, over the last four years it has been through New Mexico Tech, the State's official partnership intermediary with the Air Force. To date, the New Mexico Tech has supported the development of over: 140 CRADAs, 60 EPAs, 90 SBIR technical and business support activities (projected new revenues of over $150M), and 20 technical assistance agreements and interactions with states/labs relative to partnership intermediary development.

In addition, the Carnegie Commission has sited New Mexico Tech as a national model for technology transfer partnerships. The Air Force's highest award for technology transfer was given to AFRL's Phillips Research Site for their state and/or local government community/education outreach (over 120 schools statewide) which is coordinated by the New Mexico Tech.

New York State Technology Enterprise Corporation (NYSTEC) (http://www.nystec.com)

Founded in 1995, the New York State Technology Enterprise Corporation (NYSTEC) is a not-for-profit technology engineering and commercialization company co-located with the Air Force Research Laboratory's Information Directorate (AFRL/IF) at the Rome Research Site in Rome, NY. The company's mission is to accelerate deployment of advanced information technologies to government and industry. NYSTEC develops and evaluates technologies in a diversified set of markets, including communications, computer networks, criminal justice, environment, transportation and manufacturing. The company adapts AFRL technology, taps into AFRL expertise, and develops new high-tech solutions to benefit government and industry.

NYSTEC and AFRL/IF cooperatively develop and transfer technology through the use of Partnership Intermediary Agreements (PIAs) and CRADAs. Through the PIA, NYSTEC engineers work side by side with AFRL/IF engineers to leverage technology research and development investments, and transfer mature technologies to create innovative solutions for non-defense client needs for the betterment of small businesses. Through CRADAs, NYSTEC and AFRL/IF conduct joint research on projects of mutual benefit to the Government and NYSTEC and in turn to NYSTEC's sponsor, New York State.

NYSTEC and AFRL/IF have a number of CRADAs for the development of technologies that will benefit New York State, and potentially the nation as a whole. Among them are: 1) the development of the specifications and implementation plan for a Statewide Police Communications System using software programmable radio technology developed by AFRL; 2) the development of a New York State Advanced Telecommunications (NYSAT) system to be used by New York State agencies, departments and citizenry which uses AFRL/IF technologies in satellite communications (SATCOM), fiber-optic ground-based communications, wireless communications, etc.; 3) the adaptation of an AFRL/IF technology for use by New York State in detecting medicare fraud, waste, and abuse; 4) development of the computer security policies and procedures for a New York State Intranet (NYT); and 5) determination of state-of-the-art of technologies supporting a potential Case Management Information System for New York State Agencies (useful also for AF Judge Advocates Offices). The results of each of these CRADAs will greatly benefit New York State by improving State agency operations efficiency, decreasing infrastructure cost to the State, improving State interagency communications and cooperation, and making state government more accessible to the citizens of New York State. In addition,

each of these developments have potential to being incorporated into AF programs/offices to increase the security, efficiency, and communications of AF operations.

Wright Technology Network (http://www.wtn.org)

Wright Technology Network (WTN) is the Technology Transfer Intermediary for the five Wright Research Site (WRS) Directorates of the Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base (WPAFB). WTN is a not-for-profit corporation. The State of Ohio provides principal funding, with additional funding provided by the WRS, NASA, DOE, EPA, and other agencies. WTN facilitates CRADAs, Technical Assistance Tasks, and Commercialization of Air Force technologies.

At year's end, WTN had 26 active CRADAs to its credit and an additional seven that were completed during 1999. In addition, eight new potential CRADAs were in the process of being formalized. Furthermore, 34 Technical Assistance Tasks were active and 40 had been completed during 1999. During 1999, four major funded commercialization efforts for Air Force technologies were underway; three initial market assessments were accomplished; six issued patents were reviewed; and 27 new invention disclosures were reviewed.

WTN also provides assistance to the WPAFB Education Outreach (EO) Office to community K-12 schools. One of the many projects in the EO office is the "Tech-Trek" Mobile Research Laboratory that is equipped with a scanning electron microscope to bring science to the K-12 classrooms. WTN is an active participant in the DoD High Performance Computing Modernization Program (HPCMP) at the Aeronautical Systems Center's Major Shared Resource Center (MSRC), WPAFB.

Special Studies

Defense Acquisition Deskbook

In FY 99 a collection of information on technology transfer was submitted for incorporation into the Defense Acquisition Deskbook. The Defense Acquisition Deskbook is an electronic knowledge presentation system providing the most current acquisition policy and guidance for all DoD Services and Agencies. Information submitted to the Deskbook includes: the new DoD Directive and Instruction on domestic technology transfer, technology transfer laws, description of available technology transfer mechanisms, model CRADAs, and success stories. This information should be available on the Deskbook in March 2000.

DoD Cooperative R&D Agreements: Value Added to the Mission

A study was commissioned in FY 98 to evaluate a sampling of DoD CRADAs to assess the benefits that the DoD is reaping from participating in these agreements. Many interesting findings were deduced from the information gathered from the interviews with the federal and non-federal CRADA partners on their particular collaborations. The following findings were recurring themes described by participants in the collaborations.

- CRADAs are seen by many DoD laboratories as mission extenders
- CRADAs can provide a means for industry to talk openly with Government
- CRADAs can advance research to points that would otherwise have taken longer to achieve independently

- CRADAs can provide access to Government/Military facilities that are not otherwise commercially available
- CRADAs can result in new, improved, or more cost effective products/processes
- CRADAs can eliminate interpersonal barriers that can arise in a contractual relationship
- CRADAs are successful when objectives are clearly laid out
- CRADAs can advance research for both partners sometimes leading to new programs/contracts
- CRADAs that result in follow-on CRADAs between organizations is an indicator of progress

In supporting the belief that successful CRADAs should lead to commercial products, many of the CRADAs that were selected for evaluation in this study resulted in products or product improvements. Some of the products are either still in development or pending commercialization, however, they are at stages where they are considered to be viable products. In some cases, the use of DoD facilities or test sites provided a means for products to be further refined as a result of the data gathered by the industry partner.

In reviewing the sample of CRADAs selected, it is apparent that these collaborations do not take a simple linear route to commercialization and may only serve as one step in a series of steps along the route. Each partnership is unique in its process to meet its objectives. Some CRADA partnerships are a continuation of an earlier contractual partnership for the purposes of bringing a technology into the commercial sector. Some CRADAs lead to a patentable product or process bringing dollars back to the laboratory. Some CRADAs leverage R&D dollars and make small advances in a specific technological area which over time (and maybe many CRADAs later), may lead to a product or process that the DoD can access.

This evaluation also showed that by pooling resources through the use of a CRADA, DoD as well as the industry partner can stretch their limited R&D dollars resulting in larger research efforts than either party could fund independently. The work-in-kind contributed by both the Federal and non-Federal partners was estimated for 28 out of the 30 CRADAs evaluated in this study (assumed 1 man-year equal to $100K). The work-in-kind contributed by the Federal participants was estimated to be $4,758,850.00 with that of the non-Federal participants estimated to be $5,836,312.00. In extrapolating the figures for work-in-kind contributions for these 28 CRADAs, one can estimate the contributions for the 2456 CRADAs (cumulative since CRADAs were authorized). In doing so, the estimate for work-in-kind for the Federal partners is $417,419,128.00 and that for the industry partners is $511,927,938.00.

The amount of "cash-in" that the DoD laboratories are receiving from CRADAs is significant and has been increasing over time. These actual dollars that are coming into the laboratories cover such costs as overhead, materials, third party contracts, and travel expenses. For FY 98, the total cash-in for DoD CRADAs was $31,046,098.00. Collectively, the resources being committed to CRADAs by both industry and the DoD is comparable to other industry/government collaborative programs. In fact, in FY 98 income resulting from DoD patent licensing amounted to $1,559,387.00. The figures for both work-in-kind and cash-in illustrate the importance industry is associating with the CRADA mechanism as well as the significant contribution partnering is making to the DoD mission. In times of constrained R&D budgets, whether it be a small business, a large business or a DoD laboratory, the public and the private sector can benefit from leveraging expertise that lies outside of their own labs in areas of mutual interest. It is evident from this study, that the

CRADA mechanism is the mechanism of choice for accomplishing these partnerships. Drawing upon external expertise can provide the means to overcome obstacles that arise along the path to new discoveries or even determine that the path being pursued is leading to a dead-end and another needs to be followed. New knowledge can lead to advancing the research to the next level in the development cycle or can spawn new ideas leading to new R&D programs altogether.

Service/Agency Highlights

The decentralized approach to managing the technology transfer program in DoD enables each activity to accomplish what best meets their mission requirements. Some highlights of these activities, which are also providing value to the commercial sector, are broken out by Military Department and Agency in Appendix C.

Future Goals

The three Service laboratories have set a number of goals for FY 00. These goals include: 1) continue to conduct training in technology transfer for the Office of Research and Technology Applications (ORTAs), legal staff, S&Es and R&D managers with an emphasis on intellectual property; 2) expand marketing efforts to include enhancing individual laboratory web sites and creating brochures featuring technology licensing opportunities, unique facilities that are available for use by the commercial sector as well as in-house technical expertise; 3) expand current efforts to identify technologies with the greatest potential for commercialization thereby enhancing patent licensing activity; and 4) enhancing collaborations with external partners through partnership intermediaries, alliances, and various state and local agencies.

B. DUAL USE SCIENCE AND TECHNOLOGY PROGRAM

The ability of the United States to retain technological superiority on future battlefields will, in many cases, depend on the Nation's ability to take advantage of technological advances occurring in commercial industry. Commercial technology developments in areas such as electronics, advanced computing, communications, and medical research are racing forward. These commercial developments are funded at levels that vastly exceed what the DoD is currently able to apply. Greater reliance on commercial technologies will not only provide the Defense Department access to advances in technologies occurring in the commercial sector, but also will allow the Department to take advantage of the competitive pressures and market-driven efficiencies inherent in the commercial sectors. This competitive, market-driven approach will increase the pace at which technological improvements are incorporated into Defense systems, while at the same time reducing the costs of those systems.

The Department of Defense Dual Use Science and Technology (DU S&T) Program is designed to help the Department incorporate commercial technologies into Defense systems. The Program was established in the FY 98 Defense Authorization Act. It has two primary goals. The first goal is to jointly fund and develop dual use technologies with industry. To support this goal, the Act provides for 50/50 government/industry cost share of development. Other incentives for industry to work with the DoD DU S&T Program include access to technology from the government and increased market opportunities with the Military Services. In addition to these business incentives, the Department is making it easier for commercial companies to enter into agreements with the DoD by using procedures that are not subject to most of the Federal procurement laws and regulations. These procedures known as "Technology Investment Agreements," which include "Other Transactions" and "Cooperative Agreements," offer greater flexibility and fewer regulatory requirements than standard government contracting. The use of alternative procedures has provided the Department the ability to attract many commercial firms that would not otherwise do business with the DoD. The second goal is to make the development of dual use technologies with industry a normal way of doing business in the Services. The FY 98 Authorization Act has established goals for the initiation of dual use projects. These goals start at 5% of each Department's applied research program in FY 98 and grows to 15% by 2001. The Military Services are actively working to meet these goals through the DU S&T Program.

More than 200 companies, universities, and nonprofits are currently participating in the DU S&T Program. In the first three years, 218 projects have been initiated with a total value of over $700 million dollars. In addition to the growing size of investments, it is encouraging to see the number of commercial firms that have become involved in the Program. These firms are bringing many new ideas to the table. Service participation in the DU S&T Program has been key to the Program's success. The execution of the Program is transitioning from OSD to the Services. A fourth solicitation for proposals was issued for FY 00 in January 1999 and closed on May 4, 1999. As with the previous solicitation, this was a joint solicitation issued by the Navy and was used as a vehicle to launch an extensive outreach effort to industry. In February 1999, the DU S&T Investment Strategy Conference was held in Chicago. This was another successful conference with over 225 participants. This approach to educating industry about the Program and solicitation has proven very successful. As a result of this solicitation, the Services are currently negotiating 72 proposals for a total value of approximately $126 million worth of Dual Use technology.

The FY 01 solicitation is to be released in January 2000 and will close at the end of April 2000. It is a joint solicitation being released by the Air Force. The following technology focus areas are being solicited:

- Affordable Sensors
- Weapons Systems Sustainment
- Distributed Mission Training
- Advanced Propulsion, Power & Fuel Efficiency
- Information and Communications Systems
- Medical and Bioengineering Technologies
- Advanced Materials and Manufacturing
- Environmental Monitoring

Approximately $60 million in government funding ($30 million Service DU S&T and $30 million Service field funds) are anticipated to form new partnerships with industry and to bring commercial technology development to the benefit of the Department.

The DU S&T Program will submit a report to Congress this March. The report will include a complete description of the program and a summary of the FY 99 projects.

Examples of Some Projects Underway:

Optical Character Recognition (OCR)

This 1997 project is improving the Army's ability to collect and analyze intelligence from foreign language documents in the low-quality form that is typically found in the field by eliminating the gross inaccuracies of the commercial-off-the-shelf OCR currently being used. This enhanced capability will provide troops in the field the ability to quickly react to intelligence information. The commercial market is interested in documents from the Arabic world, where electronically represented text is relatively new and original documents must be scanned and converted.

Thermal Sprayed Nanostructural Coatings for Dual Use Applications

This 1997 project is developing highly wear, erosion, and corrosion resistant nanostructured coatings for use on ship, aircraft and land vehicles. The coatings will reduce life-cycle costs and better comply with environmental regulations. The technology is currently a leading candidate for a special Secretary of the Navy initiative to fast-track technology into the fleet. Commercial uses are in automobiles, aircraft gas turbine engines, machine tools, and mining equipment. Industry has made additional investments to begin commercializing this technology.

Affordable Antenna for Weapon System Delivery & Cellular Communications

This 1998 project will result in an affordable airborne antenna that is as capable as current antennas used in weapon systems, with higher reliability, and at only 10% of the cost of development. In addition, the antenna can be assembled in 15 minutes. The technology being utilized is scaleable for commercial cellular communications. Over 2,000 of the commercial version antennas have been sold for use in telecommunications.

C. SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

The purpose of DoD's Small Business Innovation Research (SBIR) program is to harness the innovative talents of our nation's small technology companies for U.S. military and economic strength. DoD's SBIR program funds early-stage R&D projects at small technology companies — projects that serve a DoD need and have the potential for commercialization in private sector and/or military markets. The program, funded at approximately $540 million in FY 00, is part of a larger ($1.1 billion) Federal SBIR program administered by ten Federal agencies.

As part of its SBIR program, the DoD issues an SBIR solicitation twice a year, describing its R&D needs and inviting R&D proposals from small companies — firms organized for profit with 500 or fewer employees, including all affiliated firms. Companies apply first for a six-month Phase I award of approximately $100,000 to test the scientific, technical, and commercial merit and feasibility of a particular concept. If Phase I proves successful, the company may be invited to apply for a two-year Phase II award of $500,000 to $750,000 to further develop the concept, usually to the prototype stage. Proposals are judged competitively on the basis of scientific, technical, and commercial merit. Following completion of Phase II, small companies are expected to obtain funding from the private sector and/or non-SBIR government sources (in "Phase III") to develop the concept into a product for sale in private sector and/or military markets.

Objectives of the Office of the Secretary of Defense, Deputy Under Secretary of Defense (Science &Technology) (OSD DUSD (S&T)) SBIR program, which is funded at $16.6 million in FY 99, include stimulating technological innovation, strengthening the role of small business in meeting DoD dual use research and development needs, fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and increasing technology transfer through commercial application of DoD-supported research and development results. The topics selected for the OSD program encourage technology transfer with a focus on advanced development projects with a high probability of commercialization success, both in the government and private sector.

The FY 99 Program includes the following two and ½ year projects:

- Topic OSD99-001, Microsensor Information Assurance, has the objective of developing methods of information assurance for battlefield intersensor networks. This topic is managed by Army Research Laboratory and supports the sensors/electronics technology focus area of smart sensors.

- Topic OSD99-002, Novel X-ray Detection for Large Field of View Very High Resolution Computed Tomography Inspection and Evaluation, has the objective of developing x-ray detectors for very high spatial resolution computed tomography imaging and evaluation of large areas. This topic is also managed by ARL in support of the sensors/electronics technology area.

- Topic OSD99-003, Improved Breakdown Properties in Large Area SiC Devices, has the objective of developing a method to increase the power handling capability of SiC devices by eliminating, or at least reducing, the decrease in the breakdown voltage as the size of the SiC devices increase. This topic is also managed by ARL in support of the sensors/electronics technology area.

- Topic OSD99-04, Adaptive Instructional Systems, has the objective of developing an approach to design and implementation of computer-based training systems that dynamically adapt instructional methodology to individual differences in learning style and rate, capitalize on student strengths and match content and structure of training events to the student's conceptual structure. This topic is managed by the Army Research Institute in support of the human systems technology area of cognitive readiness.

- Topic OSD99-05, Development of Metrics and a Process for Mechanical Diagnostic Technique Qualification and Validation, has the objective of developing an approach, process and metrics to impartially evaluate performance and effectiveness of mechanical diagnostic techniques based on a particular Condition Based Maintenance (CBM) application. This topic is managed by the Naval Sea Systems Command laboratory at Carderock and supports the modeling and simulation technology area.

- Topic OSD99-06, Prognostic Enhancements to Diagnostic Systems, has the objective of developing prognostic algorithms and computer software applications that will readily support backfit into existing Naval platforms employing both SMART and conventional Command, Control, and Communications (C3); Human-System Interfaces (HIS), and sensor technologies as well as extensibility into new acquisition Naval platforms. This topic is also managed by the Naval Sea Systems Command laboratory at Carderock and supports the modeling and simulation and technology areas.

- Topic OSD99-07, In-Situ Corrosion Detection and Mitigation for Inaccessible Areas, has the objective of developing the technology, manufacturing method, and associated hardware and software, to non-intrusively apply an in-situ Impressed Current Cathodic Protection (ICCP) system to detect and subsequently mitigate corrosion at hidden or hard-to-access sites in shipboard seawater systems. This topic is also managed by the Naval Sea Systems Command laboratory at Carderock and supports the materials technology area.

- Topic OSD99-08, Integrated Mechanical Load and Condition Assessment for Mechanical Components, has the objective of developing technology to reduce the cost of integrating smart sensors with machinery and processes. This topic is also managed by the Naval Sea Systems Command laboratory at Carderock and supports the sensors technology area of smart sensors.

- Topic OSD-009, Electrophoretic Processing of Electronic Polymer Materials, has the objective of developing electrophoretic processing techniques for fabrication of bulk conductive, superconductive, and ferromagnetic polymers. This project is being managed by the Air Force Research Laboratory Munitions Directorate and supports the electronics technology area.

- Topic OSD-010, Phase Tunable Spatial Light Modulator, has the objective of identifying an innovative concept for a pure phase Spatial light modulator. This project is also being managed by the Air Force Research Laboratory Munitions Directorate and supports the electronics technology area.

- Topic OSD99-11, Silicon Carbide Power Transistors for High Power Transmitter, has the objective of developing Silicon Carbide power transistors that will enable high power pulsed transmitters to achieve a stable output signal. This project is

also being managed by the Air Force Research Laboratory Munitions Directorate and supports the electronics technology area.

The FY 00 OSD Program, funded at $20 million, will fund topics in two technology areas: Cognitive Readiness and Smart Sensor Web. These are two priority technology areas in the investment planning strategy of DUSD(S&T).

Success Story

One example of a success story from the OSD SBIR program is Topic OSD95-010, titled Dental Sound Conduction Device for Scuba Mouthpiece. This project was managed by Naval Undersea Warfare Center (NUWC) in New London, CT. The SBIR contractor, Analytical Engineering, Inc. (AEI) is located in Columbus, IN. AEI has revolutionized wireless underwater communication technology by researching, developing, patenting, manufacturing, and marketing an acoustic mouthpiece and corresponding IC based single-side band ultrasonic transceiver for diver-to-diver and diver-to-surface communication. AEI developed the acoustic mouthpiece utilizing the magnetostrictive material, Terfenol-D, to perfect a low voltage transducer that is embedded inside a SCUBA diver's mouthpiece, allowing the user to hear through dental sound conduction. This is the only system in the world that allows divers to have underwater voice communication without the addition of non-standard SCUBA gear such as a full-face mask or mouth mask. Scuba diving communications capability will be available for Special Forces divers without full face masks (FFM). This will improve safety and mission effectiveness for military personnel. The Science Diving group from NUWC utilizes Soniwave communication for various underwater investigations and applications.

The acoustic mouthpiece based underwater communication developed by AEI is being sold to retail dive stores as "Soniwave" through the company, Trigger Scuba, Inc. Search and Rescue teams utilize Soniwave communication to greatly improve the safety of dive team members and improve mission success. Diving safety is improved for recreational Scuba divers through the capability of being in voice contact with their dive buddy. Underwater work, such as repair or maintenance on ships and docks, is more easily facilitated through the use of communication with topside personnel. Dive instructors are able to teach their students more effectively with Soniwave. Approximately 6 months after product launch, there were 120 Soniwave dealer stores in the United States, equating to nearly $100K in sales. Projections show steadily increasing sales. A market study from the mid-1990's showed that there were 5.5 million certified Scuba divers in the world. In the late 1990's, an average of 1 million new people per year are certified or take introductory Scuba classes. If sales reach just 1% of new divers, sales will exceed 1 million dollars.

AEI developed in-house expertise and capabilities in several technologies during the Phase II contract. Capabilities and equipment include specialized transducer design and optimization, ultrasonic transceiver design, 3-D solids modeling and CAM, plastic injection molds, IC design, and CNC machining. These capabilities have greatly enhanced AEI's capability to win R&D contracts for rapid prototype development of electro-mechanical systems. AEI was awarded a Phase I SBIR contract in mid-1995 and a Phase II SBIR contract in late 1996. Two patents have been issued for AEI's underwater voice communication system, and other patents are pending. AEI was incorporated in November 1994. SBIR funding and other R&D contracts have enabled the company to employ 6 people. AEI's growth strategy is to employ highly skilled people to develop new technologies that will be licensed to large corporations for manufacturing and distribution.

D. MANUFACTURING TECHNOLOGY (ManTech) PROGRAM

DoD's Manufacturing Technology(ManTech) Program develops new and improved manufacturing processes to facilitate more affordable production of DoD weapon systems and components. The Program addresses process technology issues from the systems development phase through transition to production and into sustainment. ManTech investments target defense-essential needs that industry would not otherwise pursue alone in a timely manner. ManTech improvements generally translate into cost avoidance or cycle time reductions. However, investments also focus on developing "new" capabilities that may result in a more expensive component, but will provide dividends in system performance or life cycle cost that far outweigh the initial cost. The Program is structured around two major thrust areas:

- Processing and Fabrication activities develop affordable processes for metals, composites, and electronics by improving factory floor and repair and maintenance facility (depots, logistics centers, and shipyards) processes.
- Advanced Manufacturing Enterprise activities accelerate implementation of world-class industrial practices, advanced design, and information systems that support weapon system development, production and sustainment.

- In addition to the two thrust areas, two special areas are emphasized:

- Energetics/Munitions projects focus on improving processes associated with propellants, explosives, pyrotechnics, reactive chemicals, and conventional munitions.
- Sustainment projects coordinate common DoD opportunities to increase the reliability and reduce the cost of repair processes for aging systems.

In response to the requirements of 10 U.S.C. section 2525(e), the Department issues an annual Five-year Plan for the ManTech Program in March of each fiscal year. The Plan, available on the Internet at http://mantech.iitri.org/pubs/pubs.html:

- Describes the ManTech Program’s goals, priorities, and investment strategy.
- Presents Military Department and Defense Logistics Agency funding for fiscal year 2000, and planned funding for fiscal years 2001 through 2005.
- Includes a description of all projects completed in the past three years and the status of implementation.
- Assesses the extent of cost sharing with commercial enterprises, Defense program offices, other Federal agencies, institutions of higher learning, and other sources.
- Summarizes program measures of effectiveness and the results of internal and independent reviews.
- Provides examples of success stories and achievements.

Technology Transfer & Dual Use

The ManTech program is driven by defense needs for technologies and systems that provide a superiority edge to the warfighters. In today's environment DoD is involving the commercial industrial base as soon as possible, by either adopting its best practices or transferring results of military processes to the commercial arena. For example:

- The Air Force ManTech program is facilitating the introduction of filmless radiography in support of aircraft nondestructive inspection. Used widely by the medical community, filmless radiography eliminates the cost of film, processing, and labor-intensive archiving by enabling images to be digitally transmitted over local area networks for immediate physician assessment. The effort with Liberty Technologies, Inc. assessed the viability of upgrading an existing commercial filmless radiography system for supporting aircraft structural inspection techniques. The new process detects corrosion, cracks, foreign object damage, moisture entrapment, and produces images ranging from 3x3 inches to 14x17 inches in size.

- The Defense Logistics Agency, the Army's Watervliet Arsenal and Benet Laboratories, and the American Metalcasting Consortium received the Hammer Award in 1999 for reinventing the Army's metalcasting design and acquisition process. The program harnesses best commercial practices, including part design, use of blanket purchase agreements with pre-qualified foundries, and improved communications between suppliers and users. Over $4 million in annual life cycle cost avoidance is projected as a result of cycle time reductions and reduced parts count generated from redesign of various weapon systems components into casting assemblies, including the M1 tank, 120mm mortar, F-22, lightweight howitzer, and other support equipment.

- Advanced Fiber Placement technology, funded by the Navy ManTech program from the early 1990s, is receiving widespread industrial base application. Sponsored by the Center of Excellence for Composites Manufacturing Technology, this process applies composite material to a tool surface using an application head mounted on a multi-axis numerically controlled machine tool. The application head cuts individual fibers, enabling fabrication of complex shapes. Initial implementation by Boeing was on the F/A-18E/F horizontal stabilator and by Northrop Grumman on the F/A-18E/F engine inlet ducts and fuselage panels. Successful technology transfer has been demonstrated the past several years with transition to the V-22 fuselage skin; F-22 pivot shaft; C-17 landing gear pod fairings; the Composites Armored Vehicle upper hull assembly; T-45 horizontal stabilator; AH-1 helicopter main rotor spars and cuffs; X-33 fuel tanks; and JSF inlet ducts. Commercial spin-offs include the Boeing helicopter 609, Boeing 777, and Raytheon Premeir.

Recent Management Initiatives & Accomplishments

The Science & Technology (S&T) Affordability Task Force continues to establish processes to strengthen the affordability content of the DoD's S&T programs. The objective is to identify mechanisms that focus DoD's technology programs on implementing Integrated Product and Process Development (IPPD), and facilitate use of Integrated Product Teams. In 1999, the Task Force:

- Sponsored a conference attended by 200 S&T managers from DoD and industry to share affordability best practices and lessons learned. The session included a panel session with each of the Service Acquisition Executives.

- Reviewed and evaluated 20 S&T programs for attention to affordability.
- Continued development of training initiatives with each of the Military Services.
- Worked with each Service to sponsor separate workshops focused on improving the process for transitioning the results of 6.3 advanced technology development efforts into acquisition.
- Published a handbook for S&T managers for use during formulation of affordability programs.

The annual Defense Manufacturing Conference continues to be a premier activity for networking and sharing the results of ongoing and completed manufacturing programs across the DoD, industry, and other government agencies. The 1999 conference was held in Miami, FL. Over 800 leaders from government, industry, and academia attended. Keynote speakers included the Honorable Jerry Hultin, Under Secretary of the Navy; Mr. Joseph Eash, Deputy Under Secretary of Defense for Advanced Systems and Concepts; and Mr. John Murphey, President, Bell Helicopter Textron. The conference featured panel sessions providing customer viewpoints from both the weapon systems and logistics community. Exchange of technical information was promoted by use of concurrent briefings spanning over 100 technical projects, and via evening receptions held with over 70 exhibitors from DoD, industry, and academia.

To improve ownership for the ManTech program, the Joint Defense Manufacturing Technology Panel (JDMTP) published an "Overarching Strategy" in December 1999. This brochure is being used to facilitate communication of ManTech's purpose, vision, role of the JDMTP, and success stories to improve program advocacy with the internal and external program customers across the DoD, with Congress, industry, and academia.

E. DEFENSE TECHNICAL INFORMATION CENTER (DTIC)

The Defense Technical Information Center (DTIC) is a major component of the Defense Science and Technical Information Program (STIP), contributing to the management and conduct of Defense research, development and acquisition efforts. DTIC provides access to and transfer of scientific, technical, and management information for DoD personnel, DoD contractors and potential contractors, and other U.S. Government agency personnel and their contractors.

DoD Technical Reports

DTIC is the central DoD repository for the collection and secondary dissemination of DoD technical reports. The reports are abstracted, indexed and cataloged, as part of DTIC's DROLS, the Defense RDT&E Online System. Through this on-line searchable database, the non-government sector of the Defense industry conducted over 28,067 searches of DTIC databases and they received 212,957 output products from DTIC in FY 99. DTIC provided 13,317 technical reports to the National Technical Information Service (NTIS). These documented results of Defense R&D contribute to technology transfer by helping private sector organizations identify DoD work in their fields of interest.

The means for searching DTIC's Technical Reports Collection via the Internet is DTIC's web site, STINET (the Scientific and Technical Information Network). The purpose of STINET is to help the DoD community access pertinent scientific and technical information to more effectively meet mission needs. There are two STINET services available via the Internet: Public STINET, which is available to the general public, and Secure STINET, which is restricted to qualified, registered users and provides encrypted transmission of citations and documents. There were over 3 million web accesses to both of the sites in FY 99. Through Public STINET, over 107,000 searches of the unclassified, unlimited distribution Technical Reports Collection were conducted in FY 99. From Secure STINET, 15,000 additional searches were conducted against the unclassified, limited distribution Technical Reports Collection and over 1,800 reports were downloaded in full text.

Defense Technology Transfer Information System (DTTIS)

DTIC maintains the DTTIS in cooperation with the Military Services and Defense Agencies. As of December 31, 1999, the DTTIS contained project information on 3,265 DoD Technology Transfer Activities, including 1,671 active Cooperative Research and Development Transfer Agreements (CRADAs) and 174 active Patent License Agreements. Approximately 100 Technology Transfer professionals are registered to use the DTTIS secure World Wide Web site to view and analyze T2 data. 1999 input into the DTTIS included 476 new records and 1578 modifications.

Independent Research and Development (IR&D) Database

DTIC maintains a database with project description and financial information reflecting Independent Research and Development efforts conducted by Defense contractor activities. In 1999, the database received 3,542 project descriptions reflecting 2.4 billion dollars in 1999 IR&D investment. It is estimated that this reflects almost 85% of the cost recoverable independent research and development efforts performed by Defense contractors. The information in the database is proprietary and disseminated to U.S. government activities only via an on-line subscription service or a CD-ROM product. In FY 00 DTIC will have available a secure IR&D World Wide Web site to better serve DoD customers in the leveraging of IR&D technology for DoD purposes.

Registration for Access to DoD Technical Information

DTIC provides centralized registration services for access to Defense technical information. The registration system authorizes DoD organizations, DoD contractors, and prospective DoD contractors access to DTIC's databases of ongoing and completed R&D, thus leveraging the nation's investment in DoD STI.

Of 4,818 registered users in FY 99, 2,661 were non-governmental users. Specifically, registered users included 1,990 industrial organizations and 671 educational organizations. DTIC facilitates awareness of technology through its registration program by targeting prospective participants in the DoD Small Business Innovation Research program and the University Research Support program, as well as through outreach to Historically Black Colleges and Universities.

DTIC's registration goal for FY 00 is to begin the transition from registering authorized organizations to registering individual end users within the organization.

Internet/World Wide Web (WWW)

The DoD continues to maintain its position as a leader in improving access to information through innovative Information Technology (IT) solutions. Advances in IT now make it possible to collect and disseminate information in a dynamic manner to assure that the latest data is made available as rapidly as possible, both to the public and to internal DoD users. In its development and maintenance of more than 80 DoD Web information systems, the DTIC is taking advantage of newly available technologies in creating applications which will gather and distribute technology transition information in the most timely and accessible manner.

This support is exemplified by two DTIC-developed Web information services: the Research and Development Descriptive Summary (RDDS) web site, and the Web-based DoD In-House RDT&E Activities Report. The new RDDS site provides the capability to access and search the reports without the necessity of rehosting data at a central location, as previously required. As the data of each Descriptive Summary remains on the Web site maintained by the issuing organization, it is now available to the entire user community as soon as it is posted. The DTIC RDDS site, which is publicly accessible, allows users to search and retrieve information from these individual sites by entering a single query at the DTIC site. The RDDS documents may be searched either by a known organization and Program Element number, or by a keyword query such as PE title or number, budget activity, fiscal year, and Agency or Service.

The Web publishing process of the annual DoD In-House RDT&E Activities Report has also greatly increased availability of information while reducing the time formerly required for collection and publication. The time needed for collection, compilation and publication of the hard-copy report has decreased by 75%, and the work-hours to produce the report have been cut by approximately 60%. Not only is the Web version of this report available in a more timely fashion, but the electronic accessibility of the data within the report allows it to be utilized with more agility and power than was possible when the document was limited to paper copy. This encourages scientists and engineers to communicate with their counterparts and enhances the potential for technology cooperation and transfer between the private sector and DoD Laboratories. The team responsible for developing this product has been presented with Vice President Gore's Hammer Award.

DoD Information Analysis Centers (IACs)

The DoD IAC Program provides access via the World Wide Web (WWW) to 13 DTIC sponsored Centers and one Army sponsored Center for the analysis of scientific and technical information. Each IAC Home Page continues to experience a steadily increasing volume of inquiry traffic from the public sector, especially in Chemical and Biological Defense, Information Assurance (Electronic Security), and Y2K issues. WWW access provides significant opportunity for technology transfer of publicly accessible Defense technical information plus a channel for two-way electronic communication with technology experts.

The DoD IAC Program has experienced steady growth, as evidenced by an increase to $100M in reimbursable dollars placed on IAC contracts in FY 99. Other accomplishments of the DoD IAC Program during 1999 include:

a. Established three new IAC contracts: Modeling and Simulation IAC, Jun 99; Weapon Systems Technology IAC, Sep 99; and Chemical Warfare/Chemical and Biological Defense IAC, Oct 99.

b. Fielded Performance Results Evaluation Management Information System (PREMIS) at 13 IACs, Defense Supply Center Columbus Contracting Office, 15 Contracting Officer's Technical Representative locations, and the DoD IAC Program Office at DTIC. This system provides IAC Program participants instant electronic access to technical area tasks status.

c. Initiated an effort to upgrade the PREMIS system from a client server version to a web-based version.

Additionally, extensive interaction is underway with three technical communities to explore the feasibility of establishing IACs in the areas of Data Fusion, Advanced Medical Technology and Warfighter Readiness.

F. INDEPENDENT RESEARCH AND DEVELOPMENT (IR&D)

In FY 99, the DoD continued to make progress in improving the management of Independent Research and Development (IR&D) and improving communications with industry. Section 2372(c)(3) of Title 10 USC provides for reasonable and timely communications of (1) DoD's planned or expected future needs to contractors, and (2) contractor's progress on IR&D programs to the DoD.

Policy and Management

The Military Departments continue to vigorously promote their respective IR&D programs. To provide coordinated leadership for IR&D activities, in 1996, DoD established a senior executive Technical Coordination Group (TCG) consisting of representatives from OSD and the Military Departments. In 1999, the TCG continued to provide the leadership and coordination necessary to maintain an effective IR&D program. For example, industry uses Defense technology planning and requirements information provided by DoD to plan industry's IR&D support of Defense needs. The leadership provided by the senior management team continues to enhance DoD's responsiveness in meeting industry's information needs. The TCG and industry representatives meet periodically to foster improvements in communications both within DoD and between DoD and industry. The meetings in 1999 addressed the issue of the trend that industry is increasingly focussing on short-term research over long-term research and what can be done to promote the long-term technology needs of DoD.

In addition to the TCG meetings that serve to coordinate the DoD and Defense contractors, a meeting of the DoD IR&D focal points was held on May 6, 1999, to improve the effectiveness of the Independent Research & Development process within the various DoD establishments. The meeting was the first of its kind and consisted of mid-level managers from the various DoD IR&D programs which until recently have been operating independently of one another. They met to discuss what united efforts can be made to implement the decisions and policy of the TCG, and they addressed specific ways the DoD can operate to more effectively receive feedback on new initiatives and communicate internally the status of efforts and events.

DoD IR&D policy is promulgated in DoD Instruction 3204.1, "Independent Research and Development (IR&D) and Bid and Proposal (B&P) Program." In May 1999, DoD issued this DoD Instruction as a revised DoD Directive to bring policy guidance in line with current law and program administration. The new document updates DoD policy and practices regarding management of IR&D, providing guidance to the Military Departments. In addition, the DoD Directive formally charters the TCG.

The Directive served as a basis for a strategic plan created by the DoD IR&D Program that listed long and short-term goals for the program addressing each aspect of the Directive in systematic fashion. This serves as a working document for implementing the Directive, and it was written so that it meshes with the goals of the Deputy Under Secretary of Defense for Science and Technology (DUSD(S&T)). The strategic plan's sponsors seek to have the IR&D programs of each Military Department likewise develop strategic plans of their own that would tie into the DoD plan.

Technical Communications from Industry

Until FY 93, IR&D project descriptions from contractors were available only in hard copy with summary descriptions in an on-line database maintained on a mainframe computer at the DTIC. In FY 93, DTIC began to distribute a streamlined electronic version of the

IR&D project descriptions on CD-ROM media for the Microsoft Windows platform. Each year, DoD and industry contributors further streamline the process. Contributing industry contractors now prepare the project descriptions on personal computers and submit them electronically. As a result, data preparation and submission costs for contractors have decreased significantly.

The CD-ROM contained over 3,500 technical project summaries valued at approximately $2.4 billion in FY 99. These submitted projects represent about 90% of the cost-recoverable IR&D efforts by Defense contractors. Company submissions to the DTIC database are voluntary. DoD continues its efforts to get as many DoD contractors as possible to submit IR&D data. Letters to non-submitting contractors explaining the potential value of these reports often results in more data submissions. Over 200 copies of the IR&D CD-ROM, containing proprietary data, are distributed each year within DoD. Users of the data can be found in Defense laboratories, systems commands, and program offices. To foster communications between DoD and industry engineers, DTIC provides the IR&D CD-ROM distribution list to industry. DTIC is now developing a restricted access World Wide Web site to distribute the IR&D data to authorized users. Resolving these information security issues will improve the cost effective distribution and access to IR&D data.

Defense Planning Documentation for Industry

The DoD makes many technology planning documents available to Defense contractors. The Defense contractors find this information valuable in making business decisions and planning contractor IR&D programs. The IR&D web pages provide access to many Defense planning documents. These sites provide access to unclassified documents for searching, viewing, and downloading by Government activities and DoD contractors only. DTIC maintains the main IR&D web site, and includes links to Military Service information. For example, the web site contains a link to unclassified documents available through the Navy Acquisition Research Information Center (NARDIC).

The DoD IR&D program has revised its web site (www.dtic.mil/ird) to make it more accessible and easy to navigate for Defense contractors. The web site developers have also sought to better integrate this program's site with those of the DUSD(S&T) (www.dtic.mil/dusdst/), the Office of Technology Transition (www.dtic.mil/ott), and other DoD sites so that planning data are more easily accessible across the board.

Matching Defense Requirements to IR&D Technologies

Technologies developed through industry's IR&D efforts represent a valuable asset for U.S. industry. In addition, emerging IR&D technologies may satisfy current and near term Defense requirements. To that end, various DoD organizations use the IR&D data from industry contributors to seek a match of DoD needs and industry's IR&D efforts. This matching of a DoD need with industry's IR&D efforts maximizes benefit to DoD and return on industry's IR&D investment.

As an example, the Air Force develops information on their infrastructure requirements. Then Air Force Materiel Command staff actively search the IR&D CD-ROM database to match industry research efforts against those infrastructure requirements. Where these searches identify an industry research effort addressing the Air Force requirement, points of contact at the requiring Air Force activity and the industry contributor are matched up.

The Army's strategy for matching its requirements to emerging IR&D technologies includes extensive use of executive conferences and technical interchange meetings with

industry. In addition, the Army widely distributes the CD-ROM database to its scientists and engineers, and Army Research Laboratory managers who support acquisition systematically compare their technology needs to the CD-ROM.

The Navy seeks to leverage IR&D investments by a process in which acquisition program managers are directly involved in searches of the IR&D CD-ROM to match industry research efforts against their S&T requirements. The Navy believes these program managers are in the best position to determine relevance of the reported IR&D to their needs.

G. TITLE III OF THE DEFENSE PRODUCTION ACT

The Defense Production Act (DPA) (50 U.S.C. App. 2061 et seq.) is the primary legislation to ensure the timely availability of industrial resources and critical technology items that are essential for national defense. The mission of Title III of the DPA is to establish, modernize, or expand domestic production capability and capacity for technology items, components, and industrial resources that are essential for national defense and for which either no domestic capacity exists or it is insufficient to meet defense needs. Title III accomplishes this by providing domestic industry with a variety of financial incentives, which reduce the risk of establishing the needed capacity. These incentives include the use of purchases or purchase commitments, loans and loan guarantees, and the purchase or lease of advanced manufacturing equipment which can be installed in government or privately owned facilities. Purchases and purchase commitments are the incentives used most frequently.

The Title III Program is unique among DoD programs. It is the only program specifically aimed at establishing or expanding domestic production capacity. Furthermore, Title III has proven to be an exceptionally effective tool for transitioning new technologies from the laboratory to the factory floor.

Title III is organized and executed as a DoD-wide program. Title III efforts generally focus on materials and components that can be used in a broad spectrum of Defense systems. The Title III Program undertakes projects that have multi-system application and enables these programs to acquire materials that would otherwise be unavailable or too expensive. The Office of the Secretary of Defense provides top-level management, direction, and oversight. The Air Force is the Executive Agent for the program and is responsible for the execution of approved and funded projects.

During 1999 six projects were active, including one new start; three were pending initiation; and two were completed. The cumulative value of all active Title III projects is approximately $76 million.

Active Projects:

Silicon Carbide (SiC) Substrates (New start in 1999)

The goal of this project is to establish long-term, world-class domestic sources of high-quality silicon carbide semiconductor substrates. This Title III project will increase material availability, improve quality, reduce cost, and accelerate the insertion of SiC technology into defense applications. It will enable the transition to full scale manufacturing by establishing the capability to produce 75mm diameter SiC substrates for device fabrication.

Future requirements for high temperature, high power applications will exceed the capabilities of second-generation semiconductor materials such as gallium arsenide and indium phosphide. Semiconductor devices fabricated on SiC will enable the development of systems with performance capabilities that are unattainable with current materials. The advantages gained by the application of SiC technology are essential for the continued technological superiority of U.S. Defense weapon systems.

In September 1999, Title III contracts were awarded to Cree Research Inc., Durham, NC; Litton Airtron Inc., Morris Plains, NJ; and Sterling Semiconductor Inc., Sterling, VA. This project is planned to run through December 2002. Title III funding is $8.5 million with the contractors investing in excess of $8.5 million in cost sharing.

Titanium Metal Matrix Composites (Ti MMCs)

The objective of this project is to establish an economically viable production capability for Ti MMC materials by reducing the cost of Ti MMC parts to affordable levels and promoting the use of such parts in gas turbine engines and other aerospace applications.

Ti MMCs will be used primarily for the fabrication of various gas turbine engine components. A major objective of the project is to demonstrate a "production ready" industry in time to incorporate this material in the Joint Strike Fighter (JSF). Other candidates for use of this material include the F-22 (F119 engine) and the F-14/F-15/ F-16 (F110 engine). Other DoD and commercial aircraft engine applications are expected to follow. This technology is vital to propulsion system improvements for the next generation of commercial and military aircraft. The project was initiated in August 1996 and is scheduled to be completed in September 2000.

Semi-Insulating Indium Phosphide (SI InP) Wafers

The goals of this project are to establish an economically viable, domestic production capability for Semi-Insulating Indium Phosphide substrates, improve material quality, and reduce material cost.

SI InP is a compound semiconductor material critical to a variety of very high frequency, millimeter wave, and high power microwave electronics applications. The existing manufacturing infrastructure for SI InP wafer production is incapable of meeting current and future Defense requirements for quality, price, size, and availability. Numerous DoD communication and weapon systems, including satellites, aircraft, and munitions, are dependent on SI InP-based devices. Additionally, SI InP is highly resistant to radiation and is essential to radiation-tolerant weapon systems and satellite components.

Title III incentives will enable the transition to full-scale manufacturing, improve quality and affordability, target military systems insertions, and leverage government investments. The Title III investment is $5.5 million, with contractor cost sharing contribution exceeding $4.0 million. This project was initiated in May 1997 with the award of contracts to American XTAL Technology, Fremont, CA and M/A-COM, Inc., Lowell, MA. This effort is scheduled for completion in May 2000.

Active Matrix Liquid Crystal Displays (AMLCDs)

This project constitutes a portion of the National Flat Panel Display (FPD) Initiative and is aimed at developing competitive domestic suppliers and providing DoD with affordable access to this advanced technology for Defense applications. Title III's primary role was to provide financial incentives to selected program offices, which used the incentives to qualify and/or accelerate purchases of flat panel displays from domestic vendors. By qualifying or purchasing flat panel displays from vendors of their choosing, the program offices were able to facilitate and/or accelerate the insertion of FPDs into military cockpit avionics and other Defense applications.

AMLCDs offer significant performance, weight, and space advantages compared with current cathode ray tube display technology and are important considerations in aircraft and space vehicle applications. Because of their advantages, AMLCDs have been inserted into a number of major Defense systems such as the AH-64D Longbow Apache, F-18 Hornet, AV-8B Harrier, C-141 Starlifter, P-3C Orion, UH-60Q, CH-46 Seaknight, and the Army's Drivers Vision Enhancer.

Title III investments of $25.8 million contributed to the early insertion of superior technology into numerous aircraft platforms and other Defense systems. This project was initiated in January 1995 and will continue through 2000.

Aluminum Metal Matrix Composites (Al MMCs)

The primary objective of this program is to design, fabricate, test, and qualify Al MMC track shoes for the Bradley Fighting Vehicle System.

The project will demonstrate that Al MMCs provide an optimal cost/performance alternative approach to fabricating military components. Replacing the current steel track with Al MMC track is expected to produce life cycle cost savings of $8.2 million per year, reduce vehicle weight by 600 pounds, and extend track shoe service life from the current 600 miles to 3000 miles. Other applications for Al MMCs include missile and space vehicle structural parts, powertrain parts, optical system components (e.g., mirrors), and electronic packaging components.

The U.S. Army Tank-Automotive and Armaments Command is executing the project via a contract with Advanced Refractory Technologies, Inc., Buffalo, NY. The contract for this project was awarded in January 1998 and will be completed in December 2001. The value of this project is $3 million.

Power Semiconductor Switching Devices (PSSDs)

The purpose of this project is to establish a viable domestic production capability able to provide DoD with assured access to medium and high power PSSDs, including MOS controlled thyristors, which will be used in both current production and retrofit programs.

Power Semiconductor Switching Devices (PSSDs) are widely used in the Defense and commercial sectors for a variety of power control, conversion, and conditioning applications. These solid state devices are used as medium and high-power electrical switches, replacing larger, heavier electro-mechanical switches. This allows for increased switching efficiency and power handling capability with reduced acquisition and life-cycle costs. These devices will be essential to future applications for aircraft, ships, and ground vehicles as well as directed energy weapons and systems such as the Electromagnetic Aircraft Launch System being developed by the Navy.

Title III incentives will be used to establish a production capacity, perform product and process improvement, and have customers evaluate and qualify devices. Total contract value is $11.5 million with Title III investing $9.7 million and the contractor cost sharing an additional $1.8 million. This project was initiated in August 1998, with the award of a Title III contract to Silicon Power Company (SPCO) of Malvern, PA. The project is scheduled to run through December 2003.

New and Pending Projects:

Laser Productive Eyewear

This project will establish a highly responsive, affordable production capacity for thin film dielectric coatings on polycarbonate substrates. The thin film coating technology will enable the production of a new generation of laser protective eyewear. The widespread use of lasers in military operations is posing an increasingly significant threat of eye injury to military personnel. The project will assure that domestic producers are available to supply these devices in sufficient quantities and at affordable prices to meet defense needs. The Title III project will use purchase and purchase commitment incentives to assist in establishing a viable, domestic capacity on a high-volume, commercial "dual produce" production line for laser protective eyewear for military and commercial applications. This project also will accelerate the implementation of compatible interference filter technologies, such as dry process holographic filters and/or rugate filters, to protect against a broader range of laser threats. Projected Title III funding is $5 million, plus cost sharing from the project contractor(s). The project is expected to run approximately 36 months.

Silicon-on-Insulator (SOI) Wafers

SOI substrates can significantly improve the performance of low power and/or radiation-tolerant integrated circuits used in Defense systems. This project will establish domestic sources for SOI wafers (up to eight inches in diameter) that have emerged from research and development but which require lower cost, higher volume production capabilities before they can be affordably inserted into DoD systems. The project is designed to provide sufficient incentives to create a domestic SOI wafer production capacity of 1.4 million square inches per year. The total value of this three-year effort, including industry cost sharing, is $9.3 million.

Microwave Power Tubes

Microwave power tubes generate and amplify microwave energy in radar systems, electronic warfare systems, and telecommunications systems where high frequency and high power are required. This project will facilitate DoD's assured access to affordable microwave power tubes by providing incentives to encourage lower tier microwave power tube suppliers to make consistent, quality-driven improvements. DoD's goal is to transition advanced manufacturing processes to the lowest-tier suppliers of components and materials; thus improving overall quality and lead times and driving down the production and life cycle costs of microwave power tubes for the DoD. The Department will use Title III authorities to facilitate supplier process improvements, qualify alternate materials and processes, and share integration and investments both horizontally across the supplier base and vertically between suppliers and microwave power tube manufacturers. Congress appropriated $3.0 million in the FY 00 Defense Appropriation Act (P.L. 106-79) specifically for this Title III project.

Completed Projects:

Small Flat Panel Displays

This project was exceptionally successful. DoD qualified a night vision heads-up-display system incorporating small format active matrix electroluminescent flat panel displays for Special Operations Forces applications, and helped establish an efficient domestic production base capable of producing affordable small format flat panel

displays for both military and commercial applications. The project began in April 1997 and was completed in February 1999.

The benefits accruing from this project are significant. Operational capabilities were significantly improved. Unit system cost is $7,000 less than previous unit system cost. Reliability was increased by more than 20 times (from 450 hours to over 10,000 hours), and the size and weight of the displays was reduced by more than 70 percent. Commercial design practices and components ensure the system will be supportable in the future. The improved capability to see in the dark and to have immediate access to critical flight information will provide the Services with an enormous advantage during military operations.

High Purity Float Zone (HPFZ) Silicon

This project, initiated in November 1993, was designed to use Title III incentives to establish a self-sustaining domestic capability to competitively produce world-class high purity float zone silicon products essential for many DoD and commercial applications. Prior to completing this Title III project, the DoD was dependent on foreign sources for all HPFZ silicon used in Defense systems.

HPFZ silicon is widely used by the U.S. Army, Navy, and Air Force for critical high power electronic devices used to control radar systems, advanced aircraft, tanks, submarines, and other weapon systems. Defense applications for HPFZ silicon center around three specific applications: high power switching devices, infrared (IR) detectors, and vidicons. High power switching devices enable the replacement of large electromechanical switches with smaller, faster, less expensive devices with greatly enhanced reliability. Defense applications for high power switching devices include radar/sonar systems, missile systems, ships/submarines, and armored vehicles. IR detectors are employed in laser seeking and heat seeking weapons systems. Vidicons convert infrared light to visible radiation for night vision applications. At its conclusion in April 1999, this project had established a full-scale, affordable, domestic manufacturing capability with the ability to provide an assured source of high quality HPFZ silicon for defense and commercial needs.

H. COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE (COSSI)

The Commercial Operations and Support Savings Initiative (COSSI) program began in FY 97 as part of the Dual Use Applications Program at the Defense Advanced Research Projects Agency (DARPA). In FY 99, at Congressional direction, the program transitioned to Service implementation with the Office of the Secretary of Defense (OSD) providing administrative oversight. The majority of the COSSI funds are appropriated directly to the Services who are responsible for execution of the program. COSSI funding appropriated to OSD is given to efforts applying to more than one Service.

The purpose of the COSSI program is to reduce Department of Defense (DoD) operations and support (O&S) costs by developing, testing, and inserting commercial technologies into fielded military systems. The cost of operating and maintaining aging equipment is a major concern for DoD. The rising costs of ownership and maintenance reduces funds available for modernization, leading to a "vicious cycle" where fewer new procurements make DoD more reliant on legacy systems raising O&S costs even more. COSSI attempts to break this cycle by using technology insertions to bring down the O&S costs of legacy systems. In addition, some military-specific components in those systems have become obsolete and hard to get at any price. Using commercial items adapted to function in military systems (instead of military unique items) can reduce maintenance costs and improve system performance. Because the commercial supplier underwrites the cost of developing the commercial component, DoD saves on R&D expenses.

COSSI is a two-stage process. In Stage I, firms or teams submit proposals that include at least one for-profit firm. The proposal must include written support from a “Military Customer” who has the authority to modify the system and purchase the kits in Stage II. During Stage I, modifications are made to the core commercial product to adapt it for military use. The item is then tested to ensure it performs satisfactorily in the selected application and operational environment, with no degradation in overall system performance. Stage I is usually completed within 24 months. If Stage I is successful, the Military Customer may then use procurement funds to contract for reasonable production quantities in Stage II.

Effectiveness

COSSI establishes government and industry partnerships. Projects are cost-shared between the government and industry reducing the expense of developing and qualifying a commercial product for use in a military system. Cost sharing also signifies the contractor’s commitment to the long term success of the project. By involving commercial suppliers, COSSI is making an important contribution in a process of creating an integrated military and commercial industrial base.

COSSI uses the Other Transaction Authority (OTA) provided by Section 804 of Public Law 104-208 for all Stage I projects. The OTA allows for streamlined acquisition agreements and fosters teamwork between the Department and the contractor. Red tape associated with traditional Defense contracts, intellectual-property rights, access to data, etc., are often viewed by technology-oriented companies as impediments to working with the Government. COSSI has taken on a leadership role in promoting the use of OTAs and is helping DoD achieve acquisition reform.

Status

COSSI has just completed the third competition (FY 00). The solicitation was announced in June 1999 and twenty proposals were received by mid-September. Eleven of these proposals have been selected for award.

Future Plans

The next COSSI solicitation is scheduled for the second quarter of FY 00. Proposals will be submitted by contractors, and evaluated and ranked by the Services. We expect selections to be announced in August.

Accomplishments

Thirty Stage I projects were selected in the initial COSSI solicitation issued in FY 97. During FY 99, the two projects listed below transitioned into production. More projects started in FY 97 will be transitioning to production during FY 00.

Discontinuous Reinforced Aluminum (DRA)

Two companies (Cyclone Aviation and United Fasteners) are fabricating fuel access panels and ventral fins for F-16s using the wider DRA sheets (widths from 27” to 36” and in some cases larger). In FY 00 three companies plan to use the material for 220 aircraft. Eventually the Air Force will buy fuel access panels (8 per aircraft) for 54 Block 10/15 and 337 Block 25/30/32 aircraft, and ventral fins (2 per aircraft) for 54 Block 10/15 and 404 Block 25/30/32 aircraft. The material is also being considered for F-16 engine access covers.

Mini-MUTES Replacement Processor

The AN/MST-T1(V) Mini-Multiple Threat Emitter System (Mini-MUTES) is an Air Force Electronic Warfare training system that simulates threat radars so aircrews can practice countermeasures. The current Mini-MUTES relies on an aging proprietary computer processor that requires a continuously controlled environment. The COSSI project replaced obsolete hardware and re-hosted software on a robust VME bus based system. The Stage II production and installation has been bundled with other Air Force upgrades. There are 44 production kits programmed with an Air Force plan to buy the first 20 during FY 00.

Appendix A: **P.L. 102-484, Section 4225, 10 USC 2515, Office of Technology Transition**

National Defense Authorization Act for Fiscal Year 1993
(Enrolled Bill (Sent to President)

SEC. 4225. OFFICE OF TECHNOLOGY TRANSITION.

(a) ESTABLISHMENT- Subchapter III of chapter 148, as amended by section 4224, is further amended by inserting after section 2514 the following:

`Sec. 2515. Office of Technology Transition

`(a) ESTABLISHMENT- The Secretary of Defense shall establish within the Office of the Secretary of Defense an Office of Technology Transition.

`(b) PURPOSE- The purpose of the office shall be to ensure, to the maximum extent practicable, that technology developed for national security purposes is integrated into the private sector of the United States in order to enhance national technology and industrial base, reinvestment, and conversion activities consistent with the objectives set forth in section 2501(a) of this title.

`(c) DUTIES- The head of the office shall ensure that the office—

`(1) monitors all research and development activities that are carried out by or for the Military Departments and Defense Agencies;

`(2) identifies all such research and development activities that use technologies, or result in technological advancements, having potential nondefense commercial applications;

`(3) serves as a clearinghouse for, coordinates, and otherwise actively facilitates the transition of such technologies and technological advancements from the Department of Defense to the private sector;

`(4) conducts its activities in consultation and coordination with the Department of Energy and the Department of Commerce; and

`(5) provides private firms with assistance to resolve problems associated with security clearances, proprietary rights, and other legal considerations involved in such a transition of technology.

`(d) REPORTING REQUIREMENT- The Secretary of Defense shall submit to the Committees on Armed Services and on Appropriations of the

Senate and the House of Representatives an annual report on the activities of the Office at the same time that the budget is submitted to Congress by the President pursuant to section 1105 of title 31. The report shall contain a discussion of the accomplishments of the Office during the fiscal year preceding the fiscal year in which the report is submitted.'.

(b) SCHEDULE FOR ESTABLISHMENT- The Office of Technology Transition shall commence operations within 120 days after the date of the enactment of this Act.

(c) REPORTING REQUIREMENTS- (1) Not later than 180 days after the date of the enactment of this Act, the Secretary of Defense shall submit to the congressional defense committees a report on the establishment of the Office of Technology Transition. The report shall contain a description of the organization of the Office, the staffing of the Office, and the activities undertaken by the Office.

(2) Notwithstanding section 2515(d) of title 10, United States Code (as added by subsection (a))—

(A) the first report under that section shall be submitted not later than one year after the date of the enactment of this Act; and

(B) no additional report is necessary under that section in the fiscal year in which such first report is submitted.

Appendix B: **DoD Laboratories' Technology Transfer Activities**

Number of Reported Active Technology Transfer Mechanisms*
per Service/Agency

Service	FY 95	FY 96	FY 97	FY 98	FY 99
Army	552	639	684	795	1504
Navy	148	139	297	387	479
Air Force	53	42	342	393	293
Defense Advanced Research Projects Agency	2	2	19	17	6
National Imagery and Mapping Agency	0	0	2	4	10
TOTAL	**755**	**822**	**1,344**	**1,596**	**2,292**

* Technology Transfer Mechanisms include Cooperative Research and Development Agreements (CRADAs), Patent License Agreements, Educational Partnership Agreements, Use of Facility Agreements, and Personnel Exchange Agreements.

Number of Reported Active Technology Transfer Mechanisms by LaboratoryCenter
FY 95 through FY 99

Laboratory/Center	FY 95	FY 96	FY 97	FY 98	FY 99
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY	2	2	19	17	6
ABERDEEN TEST CENTER			3	2	2
AERONAUTICAL SYSTEMS CENTER, WRIGHT-PATTERSON AFB			6	6	3
AIR FORCE DEVELOPMENT TEST CENTER EGLIN AFB	1	2	8	3	3
AIR FORCE FLIGHT TEST CENTER, EDWARDS AFB CA	5	6	8	13	15
AIR FORCE MEDICAL CENTER, WRIGHT-PATTERSON AFB			2	2	0
AIR FORCE MATERIAL COMMAND	17	24	87	72	14
ARMY AEROMEDICAL RESEARCH LAB	9	17	17	20	30
ARMY ARMAMENT RESEARCH DEVELOPMENT AND ENGINEERING CENTER	10	20	27	40	47
ARMY AVIATION RESEARCH AND TECHNOLOGY ACTIVITY	31	38	7	16	
ARMY AVIATION RESEARCH AND TECHNOLOGY ACTIVITY FT EUSTIS VA					21
ARMY AVIATION RESEARCH AND TECHNOLOGY ACTIVITY MOFFETT FIELD CA					34
ARMY AVIATION RESEARCH DEVELOPMENT AND ENGINEERING CENTER	2	2	2	2	5
ARMY CECOM INTELLIGENCE AND ELECTRONIC WARFARE DIRECTOR	6	7	10	11	12
ARMY CECOM RESEARCH DEVELOPMENT AND ENGINEERING CENTER	22	29	30	34	44
ARMY COMMUNICATIONS-ELECTRONICS COMMAND FT BELVOIR VA	4	6	12	11	18
ARMY ELECTRONIC PROVING GROUND FT HUACHUCA AZ	1	1	1	1	1
ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS	22	27	43	56	105
ARMY INSTITUTE FOR SURGICAL RESEARCH FT SAM HOUSTON TX	1	1		4	6
ARMY MEDICAL RESEARCH AND MATERIEL COMMAND FT DETRICK MD	8	6	5	6	17
ARMY MEDICAL RESEARCH INSTITUTE OF CHEMICAL DEFENSE	1	2	1	1	11
ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASES	57	66	66	70	103
ARMY MISSILE RESEARCH DEVELOPMENT AND ENGINEERING CENTER	6	10	11	15	27
ARMY NATICK RESEARCH DEVELOPMENT AND ENGINEERING CENTER	18	20	31	39	56
ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES	1	5	5	6	6
ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE	8	11	11	20	26
ARMY RESEARCH LAB	109	117	151	165	
ARMY RESEARCH LAB ABERDEEN PROVING GROUND MD					68
ARMY RESEARCH LAB ADELPHI MD					62
ARMY RESEARCH LAB CLEVELAND OH					1

Laboratory/Center	FY 95	FY 96	FY 97	FY 98	FY 99
ARMY RESEARCH LAB FORT MONMOUTH NJ					97
ARMY RESEARCH LAB HAMPTON VA					31
ARMY RESEARCH LAB WHITE SANDS MISSILE RANGE NM					5
ARMY RESEARCH OFFICE, RESEARCH TRIANGLE PARK			1	1	1
ARMY SPACE AND STRATEGIC DEFENSE COMMAND	3	4	2	1	7
ARMY TEST AND EVALUATION COMMAND, ABERDEEN PROVING GROUND			1		0
ARMY TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT ACTIVITY	1				1
ARMY TOPOGRAPHIC ENGINEERING CENTER	3	2	2	4	6
ARNOLD ENGINEERING DEVELOPMENT CENTER		1	2	2	0
CENTER FOR HEALTHCARE EDUCATION AND STUDIES	2	1	1	1	2
CLINICAL INVESTIGATION REGULATORY OFFICE	30	38	34	95	179
COLD REGIONS RESEARCH AND ENGINEERING LAB	28	28	25	34	89
CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY)	33	34	39	48	73
DEFENSE LANGUAGE INST MONTEREY CA	4	5	4	3	4
EDGEWOOD RESEARCH DEVELOPMENT AND ENGINEERING CENTER	2	5	11	21	27
ELECTRONIC SYSTEMS CENTER	15	12	8	25	13
JOINT TRAINING ANALYSIS & SIMULATION CENTER, SUFFOLK			1	1	1
NATIONAL IMAGERY AND MAPPING AGENCY			2	4	10
NATIONAL IMAGERY AND MAPPING AGENCY BETHESDA MD					2
NATIONAL IMAGERY AND MAPPING AGENCY RESTON VA					7
NATIONAL IMAGERY AND MAPPING AGENCY ST LOUIS MO					1
NAVAL AIR WARFARE CENTER AIRCRAFT DIV	10	10	14	20	
NAVAL AIR WARFARE CENTER AIRCRAFT DIV LAKEHURST NJ					1
NAVAL AIR WARFARE CENTER AIR CRAFT DIV WARMINSTER PA					16
NAVAL AIR WARFARE CENTER TRAINING SYSTEMS DIVISION, ORLANDO			2	7	9
NAVAL AIR WARFARE CENTER, WEAPONS DIVISION, CHINA LAKE	13	12	34	43	51
NAVAL AIR WARFARE CENTER, WEAPONS DIVISION, PT MUGU			6	9	10
NAVAL MEDICAL RESEARCH DEVELOPMENT COMMAND	33	32	39	45	71

Laboratory/Center	FY 95	FY 96	FY 97	FY 98	FY 99
NAVAL METEROLOGY & OCEANOGRAPHY COMMAND, STENNIS SPACE CTR			2	3	4
NAVAL POSTGRADUATE SCHOOL	8	7	6	9	6
NAVAL RESEARCH LAB	44	36	64	79	
NAVAL RESEARCH LAB STENNIS SPACE CENTER MS					3
NAVAL RESEARCH LAB WASHINGTON DC					106
NAVAL SURFACE WARFARE CENTER DAHLGREN DIV	9	10	14	18	36
NAVAL SURFACE WARFARE CENTER INDIAN HEAD DIVISION	8	8	9	14	13
NAVAL SURFACE WARFARE CENTER, CARDROCK			14	18	25
NAVAL SURFACE WARFARE CENTER, CRANE, IN			8	10	7
NAVAL UNDERSEA WARFARE CENTER KEYPORT DIVISION	2	3	4	3	3
NAVAL UNDERSEA WARFARE CENTER NEWPORT DIV	17	17	21	25	28
NAVY CLOTHING & TEXTILE RESEARCH FACILITY, NATICK			2	2	2
OFFICE OF NAVAL RESEARCH, ARLINGTON			39	45	*
OGDEN AIR LOGISTICS CENTER	2	4	24	12	6
OKLAHOMACITY AIR LOGISTICS CENTER		1	1	1	0
SAN ANTONIO AIR LOGISTICS CENTER, KELLY AFB			3	3	0
SPAWAR SYSTEM CENTER, SAN DIEGO	2	2	18	24	22
TACOM RESEARCH DEVELOPMENT AND ENGINEERING CENTER	31	33	28	37	67
TRADOC ANALYSIS CENTER	1	1	1	1	1
UNIFORMED SERVICES UNIV OF THE HEALTH SCIENCES	1	1	2	2	3
WALTER REED ARMY INST OF RESEARCH	83	84	89	104	179
WARNER ROBINS AIR LOGISTICS CENTER	4	4	8	13	11
WATERVLIET ARSENAL	11	15	8	13	23
WRIGHT LAB	6	10	73	22	5
YUMA PROVING GROUND	1	3	3	4	5

* ONR has cooperative agreements and Other Transaction Authority contracts that were counted in past years, but not in FY 99.

Some new activities began reporting data in FY 98. Additionally, the Air Force Research Laboratory began reporting using it's new title and Directorate designations. Therefore, these activities are reported below:

Laboratory/Center	FY 98	FY 99
AIR INTELLIGENCE AGENCY	2	12
AFRL MUNITIONS DIRECTORATE, EGLIN AFB	3	8
AFRL KIRTLAND AFB		32
AFRL DIRECTED ENERGY DIRECTORATE, KIRTLAND, AFB	26	
AFRL SPACE VEHICLES DIRECTORATE, KIRTLAND, AFB	12	
AFRL INFORMATION DIRECTORATE, ROME, NY	9	27
AFRL WRIGHT-PATTERSON OH		110
AFRL AIR VEHICLES, WPAFB	19	
AFRL MATERIAL DIRECTORATE, WPAFB	12	
AFRL PROPULSION DIRECTORATE, WPAFB	17	
AFRL SENSORS DIRECTORATE, WPAFB	8	
AFRL HUMAN EFFECTIVENESS DIRECTORATE, WPAFB	35	
NAVAL FACILITIES ENGINEERING SERVICE CENTER, PORT HUENEME, CA	2	1
NAVAL MEDICAL CENTER, SAN DIEGO CA	4	10
NAVAL OBSERVATORY, DC	1	1
NAVAL SURFACE WARFARE CENTER, PORT HUENEME, CA	2	2
NAVY EXPERIMENTAL DIVING UNIT	1	1
WHITE SANDS MISSILE RANGE	1	1

Activities reporting for the first time in FY 99 are reported below:

Laboratory/Center	FY 99
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB	7
ARMSTRONG LAB BROOKS AFB TX	1
DEFENSE NUCLEAR AGENCY ALBUQUERQUE NM	1
DEFENSE NUCLEAR AGENCY ALEXANDRIA VA	5
HUMAN SYSTEMS CENTER BROOKS AFB TX	1
HYDROLOGIC ENGINEERING CENTER DAVIS CA	1
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECH CTR INDIAN HEAD MD	4
NAVAL SEA SYSTEMS COMMAND WASHINGTON DC	1
PHILLIPS LAB EDWARDS AFB CA	6
ROME LAB ROME NY	12

Appendix C: **Service / Agency Highlights**

Army

Adaptation of Intermediate Moisture Food Technology Produces Quality Rations

The team of Jack Briggs, Michelle Richardson, and Dr. Andre Senecal, U.S. Army Soldier and Biological Chemical Command (SBCCOM), Natick Soldier Center (NSC) received a 1999 FLC Award for Excellence in Technology Transfer for achieving a technical breakthrough in developing military rations that look freshly prepared yet can be kept at room temperature for up to three years. Besides meeting Army mobilization requirements, the technology reflects innovations in intermediate moisture food (IMF) technology, which carefully balances moisture, pH, and water binding to give foods soft, moist qualities without promoting microbiological growth. The team's work led to the development of several types of pocket sandwiches.

The team's transfer of IMF technology to industry resulted in the commercialization of the rations with Sara Lee Bakery. Working under two CRADAs, Sara Lee Bakery and NSC are actively producing extended shelf-life bakery items that do not require refrigeration. A second CRADA with GoodMark Foods, Inc. focuses on developing and commercializing the meat-filled sandwich components. The team's success has also resulted in inquiries from other major industrial food organizations.

The technology simplifies shipping, distribution, and handling and increases soldier acceptance, mobility, and consumption. The team's work also demonstrates how Federal lab technology can strengthen the U.S. industrial base—providing synergistic benefits to all partners.

Formulation of a Liposomal Transdermal Vaccine System and Other Novel Pharmaceuticals

MEDICAL TECHNOLOGY and Practice Patterns Institute

In April 1999, U.S. immunologists made a major discovery. Immunization could be induced by simply adding an antigen like influenza, diphtheria, or tetanus to cholera toxin (CT)--a bacterial product commonly used to enhance the immune response, dropping the mixture on the skin, and applying a band aid. This new, needle-free technique successfully induced immunization in a broad range of animal tests; moreover, the technique excelled by producing both blood-borne antibodies and harder-to-achieve mucosal immunity. The technique, called transcutaneous immunization (TCI), received its patent on November 9, 1999.

The TCI discovery, can be credited in part to the Walter Reed Army Institute of Research (WRAIR) through research performed under a CRADA. The CRADA, which initially partnered WRAIR and the non-profit Medical Technology and Practice Patterns Institute (MTPPI), began with developing a vaccine technology to devise an effective, safe, and easily administered delivery mechanism for vaccination. The WRAIR-MTPPI team's first patented needle-free technique was for liposomal transcutaneous vaccination. Under the CRADA, MTPPI licensed the vaccine technology and then sublicensed the technology to a new company, IOMAI Corporation.

The FDA has approved TCI's Investigation of New Drug Application (NDA); this approval opens the way for human trials. Initial key commercial markets may include the influenza and tetanus vaccine markets. WRAIR and IOMAI, in partnership with other immunology specialists, are also exploring TCI applications for possible vaccines against cancer and HIV. The CRADA between WRAIR and IOMAI is continuing.

Vaccines for Infectious Diseases

Ora Vax and Walter Reed Army Institute of Research (WRAIR) are working together in a CRADA to manufacture vaccines for such diverse ailments as peptic ulcers, which can lead to stomach cancer, and Japanese encephalitis. The collaboration focuses on producing products ready for use in Phase I and Phase II clinical trials. WRAIR is contributing the controlled facilities required for this type of production, while Ora Vax is providing the resources and revenue to the WRAIR mission and will work to manufacture and commercialize the vaccines.

Heat Stress Monitor (HSM)

The hand-held miniature Heat Stress Monitor is an electronic device that automatically measures air temperature, wind speed, humidity, solar radiation, and barometric pressure, and uses embedded physiological models to provide tailored guidance on optimal work/rest cycles, maximum safe work times, and hourly drinking water needs. A CRADA between the U.S. Army Research Institute of Environmental Medicine (USARIEM) and Occ-Consult, Australia, entitled: "Production Development of a Hand Held Heat Stress Monitor for Application in Australian Industry," resulted in 30 prototype miniature HSMs being built and tested in deep mine environments in Australia. This development effort leveraged several hundred thousands of dollars in industry funding resources for heat stress management technologies needed to support occupational health and safety in deep mine operations.

Anti-Freeze Proteins

A/F Protein Inc.

Preliminary findings related to the CRADA between the U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, MA, and A/F Proteins, Incorporated, Waltham, MA, show that the company's proprietary preparation (AFP-1) protects a model of human skin against injury caused by freezing at -8 degrees C. Testing is currently being repeated and if successful, AFP-1 may be included in a skin cream to be tested in its ability to protect soldiers against frostbite during cold weather military operations or recreational activities. If successful in protecting against frostbite, its potential for civilian application in cold-weather recreational activities (e.g., winter skiing, camping, ice-fishing) or commercial enterprises (e.g., winter fishing, mining) is very promising.

The Lasform SM System

AEROMET™

Using a CRADA, a team of Army Research Laboratory engineers successfully completed a technology transfer of a new laser forming rapid prototyping technology: the Lasform SM process and system. This technology was commercialized by AeroMet, a subsidiary of MTS Systems Corporation, both of Eden Prairie, Minnesota. AeroMet was founded in 1997 with the sole purpose of commercializing the ARL's vision and direction in rapid prototyping. The Lasform SM system is the largest rapid prototyping system in the world. The process is a flexible, one-step method in which a powdered

metal is deposited as molten droplets onto a metallic substrate located beneath the focused beam using computer numerical control instructions. The resulting near net geometry of parts provides many advantages when compared to conventional metal forming systems.

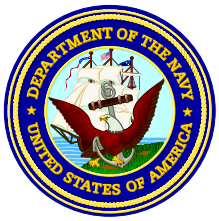
Low Temperature Battery

The U.S. Army Communications and Electronics Command Research, Development and Engineering Center, Command/Control Directorate has developed a low temperature electrolyte battery for the U.S. Army and other government agency use under a DARPA funded Technology Reinvestment Program (TRP). The current commercial lithium battery cannot operate when the temperature falls below –20 C. The Army has pioneered the development of a new leading low temperature electrolyte for lithium battery technology which has opened the door for the electric car to become a reality in the near future. Seventy-three percent higher energy in "D" size cells have been demonstrated at –30 C. Saft America, Inc. not only chose this electrolyte instead of their own electrolytes for their own commercial batteries, but also uses this electrolyte for NASA/Air Force military programs. This low temperature electrolyte has been selected by NASA/JPL for the 2001 Mars Lander/Rover mission. The Air Force has also used this electrolyte to meet their low temperature battery requirements.

Improvements to the Laser Pattern Generator

Rochester Photonics Corporation
DIFFRACTIVE OPTICS SPECIALISTS

Through a CRADA between the U.S. Army Communications and Electronics Command Research, Development and Engineering Center and Rochester Photonics Corporation, improvements were made to the Laser Pattern Generator by writing surface relief structures in photoresist. This work will enable Rochester Photonics Corporation to further develop various head-mounted displays. This CRADA was an additional phase of work in connection with an on going Cooperative Agreement that is focusing on developing varying diffractive optics technology for a variety of commercial and military equipment. The statement of work for the Cooperative Agreement did not anticipate the research necessary to upgrade the equipment to make the newly developed diffractive optic elements. Therefore, a CRADA was selected as the mechanism of choice for carrying out the unanticipated work. The diffractive optical elements, which were made from the improved Laser Pattern Generator, will be incorporated into virtually all of the optical systems or testbeds made as part of an ongoing project, including the full-color, liquid crystal based head-mounted displays, a CRT based head-mounted display, and an IR zoom lens assembly for missile guidance.



Navy

Innovative Flat Panel LCDs Offer Many Military and Commercial Uses

Dr. Ranganathan Shashidar, U.S. Naval Research Laboratory (NRL) received a 1999 FLC Award for Excellence in Technology Transfer for his work in pioneering the development of novel liquid crystal materials for advanced optical display devices and information processing and successfully transferring the technologies to the commercial and military sectors. His work encompasses two critical areas of liquid crystal displays (LCD)—the alignment of liquid crystals and the design of plastic substrates for LCDs.

In 1996, NRL entered a CRADA with Shipley Company and proposed Dr. Shashidar's novel approach to liquid crystal alignment as an alternative to conventional processing of LCDs. The CRADA was so successful that it was extended twice. Under the most recent extension, Shipley was granted a partially exclusive right and license to practice three of the inventions in the field of LCD manufacturing.

In 1997, NRL and Opticom ASA entered a CRADA to select, develop, and build a printing system to apply high resolution patterns of conducting and semiconducting materials onto flexible plastic substrates. This CRADA was recently amended to focus on commercialization.

Commercial applications of the technologies include flat panel displays of all kinds and are expected to significantly affect the $22 billion LCD industry. The technologies could replace the traditional polyimide process in existing manufacturing lines and may open new lines.

Chaos Control Applied to Cardiac Fibrillation and Epileptiform Behavior in the Brain

Dr. Mark L. Spano and Dr. Visarath In, Naval Surface Warfare Center, Carderock Division, received a 1999 Federal Laboratory Consortium (FLC) Award for Excellence in Technology Transfer for their life-saving work on the application of chaos control to cardiac fibrillation and epileptiform behavior in the brain.

The doctors investigated controlling atrial fibrillation by altering and regulating local electrical activation of the high right atrium during atrial fibrillation—the most common arrhythmia requiring treatment. They also tried to regularize the electric spiking of the brain during epileptic seizures. In a CRADA with the Georgia Institute of Technology and Emory University, they began a course of experimental investigations that led to the successful application of chaos control.

Dr. Spano led his group in aggressively pursuing academic and commercial involvement in marketing applications of chaos control. This led to an innovative marketing agreement between UCLA and the Navy, which resulted in a license for the initial cardiac work to Medtronic, Inc. and Control Dynamics, Inc.

These techniques are now being applied to ventricular fibrillation—a severe heart dysfunction that is the leading killer of adults in the U.S. If this effort is as successful as the previous work, many lives could be saved.

Malaria Genome Project

The Naval Medical Research Center (NMRC) collaborates with a number of companies in an effort to produce vaccines and vaccine applications relevant to both DoD and the commercial sector. NMRC's CRADA with The Institute for Genomic Research (TIGR) involves the use of cutting edge technology in order to determine the DNA sequence of two human malaria parasites. Malaria is a disease which traditionally has exerted a large negative impact on DoD field operations. Discovery of the malaria parasites' DNA sequences will increase understanding of the parasites and may lead to the development of better therapeutics and vaccines.

Some successes have already been attained. As published in the November 6, 1998, edition of *Science* Magazine, the NMRC-TIGR partnership resulted in the complete DNA sequence of Chromosome 2, the sequence for 1 million of the nucleotide base pairs under investigation. Naval Commander Daniel Carucci, principal investigator on the project for NMRC, stated that this success was the first of many and would not have been possible without the CRADA mechanism. The CRADA mechanism will hasten the development of new intervention strategies against malaria by partnering cutting genomic sequencing technology with the Navy's prestigious malaria vaccine program.

Vice Admiral Bowen Award

This past year, Erich Baitis and Dennis Woolaver were recognized by the Chief of Naval Research (CNR) for their invention that allows a ship to perform its motion-sensitive warfare tasks by reducing these motions with the rudders while simultaneously steering the ship as well or better. This use of the rudder for simultaneous steering and roll stabilization was patented. Mr. Baitis and Mr. Woolaver were presented with the Vice Admiral Bowen Award, which is named in honor of Vice Admiral Harold G. Bowen, who was the first CNR. The award honors one patent annually that is determined to have had a significant impact upon the sailor and the Navy.

The invention, called the Rudder Roll Stabilization (RRS), uses the rudders to compensate for wind- and wave-induced roll motions. The RRS invention provides substantial roll reductions without negatively affecting either the ship's steering or the reliability of the steering machinery. Since every ship has to have a steering system, the use of this system to simultaneously stabilize the ship in roll and thus increase the ship's seakeeping qualities has provided the U.S. Navy with a cost-effective method of improving ship's capabilities to perform assigned missions in heavy weather.

The RRS function was incorporated into the DDG 51 production steering system by integrating it directly into the autopilot. This full integration into the steering system then deleted the additional steering redundancy featured in the patented system. A 20% to 30% operational gain using rudder roll stabilization was observed in rough weather seasons. In a combat situation, this could translate into the difference between successfully defending the ship or losing the ship. As a direct result of the experience on the first four ships of the DDG 51 Class, the decision was made to outfit the entire ship class with the RRS system as an integral part of the ships' steering controllers.

The U.S. Navy currently deploys 26 RRS systems, with one system in DDGs 51 through 77. Furthermore, each of the follow-on ships will have the RRS system installed as a component of the normal steering system. The use of the RRS in future naval combatants will increase as the ships are built. Plans are being made to outfit the DD 21, and the follow-on CVs with RRS as part of their autopilot systems.

The Coastal Systems Station Issues a Non-exclusive License for Fire Helmet Communications

In 1994, three Pittsburgh Firemen lost their lives in what should have been a routine fire. The NASA Mid-Atlantic Technology Applications Center (MTAC) collaborated with the Chief of the Pittsburgh Fire Department to search the Federal laboratories for technologies that would be applicable to the fire fighting community in order to prevent such tragic incidents from occurring.

In November 1997, CSS demonstrated its capabilities in head contact microphone technology (HCM), originally developed for the Navy Seals), to the Pittsburgh Fire Department. Benefits of the HCM include: hands-free communication, interoperability, waterproofness, and increased voice clarity/ambient noise rejection. CSS was asked to put together an initial prototype showing how the HCM could be adapted to a fire helmet and demonstrate it to members of the Pittsburgh Fire Department Administration (PFDA). The PFDA supplied CSS with a fire helmet to construct Bench Prototype II.

The Prototype II was demonstrated in March 1998 at the Pittsburgh Fire Department Training Center. Industry companies were invited to a public demonstration during a live fire test. MTAC referred Radio Ear to CSS for potential licensing and commercialization of HCM to the fire fighting community. A nonexclusive license was issued in April of 1999.

Intellectual Property Management Information System (IPMIS)

The Office of Naval Research has developed the Intellectual Property Management Information System (IPMIS) to track all of the Navy's inventions and licensing activities. The invention tracking portion of IPMIS is in operation and nearly all eighteen of the Navy Offices of Patent Counsel are currently using it to track all of their inventions. IPMIS tracks inventions from the disclosure of the invention through the filing of any applications for patent in the United States Patent and Trademark Office. IPMIS also tracks the issuance of a patent including payment of fees. It is planned that IPMIS will track the licensing of all Navy inventions. ONR currently has an internal tracking system for the Navy's licensing efforts.

1-800-NAVYTEC

For the last several years ONR has maintained a 1-800 line (1-800-NAVYTEC) at the National Technology Transfer Center via which it attempts to match the technology needs of civilian firms with the technologies and technological expertise of the Navy laboratories.

Air Force

Highly Reliable Heterojunction Bipolar Transistor (HBT Circuits)

The team of Chris Bozada, Charles Cerny, Greg DeSalvo, Ross Dettmer, Jack Ebel, Tom Jenkins, Jim Gillespie, Kenichi Nakano, 1Lt. Carl Pettiford, Tony Quach, Jim Sewell, G. David Via, 1Lt. Ryan Welch, Air Force Research Laboratory (AFRL) Sensors Directorate won a 1999 FLC Award for Excellence in Technology Transfer for successfully transferring AFRL's patented thermally-shunted heterojunction bipolar transistor (TSHBT) technology to industry – specifically to Northrop Grumman's Electronic Sensors and Systems Division. TSHBT is a high-performance electronic device that has state-of-the-art performance for microwave power amplification.

The achievement was recognized by a large number of domestic and foreign companies that actively sought information and collaboration to benefit from the team's work. Efforts with Lockheed Martin, Hughes, Epitronics Corporation, Motorola, MA/COM, and M-Pulse ranged from information exchanges to working side-by-side to learn the detailed fabrication process. M-Pulse was able to produce a new product line based on this combined effort.

The team was competitively selected to transfer the technology to industry under the Federal Defense Laboratory Diversification (FDLD) program. The Northrop Grumman/Epitronics team was chosen to transfer and develop dual-use microwave products and a MMIC foundry process based on the Air Force technology. After FDLD programs were cancelled in 1996, the strength and success of the program were significant enough to continue the transfer under the Dual Use Applications program.

HBT technology has become the device of choice for cellular phone power amplifiers. The most tangible benefits of the technology are the simpler and cheaper design for cellular phones and longer operating times due to decreased power drains. The impact of this market is immense, and the breakthroughs of this technology will benefit the cellular phone industry through improved power, gain, linearity, and efficiency.

Performance-Enhancing Refrigerant Additive Reduces Energy Consumption

Joseph Gottschlich, Air Force Research Laboratory (AFRL), Propulsion Directorate won a 1999 FLC Award for Excellence in Technology Transfer for QwikBoost—a recent AFRL spin-off. QwikBoost is a low-cost refrigerant additive that increases the performance of air conditioners, heat pumps, refrigerators, and freezers using new, environmentally friendly, hydrofluorocarbon (HFC) refrigerants. Mainstream Engineering Corporation developed QwikBoost under an Air Force Phase II SBIR program.

Mr. Joseph Grottschlich formed a government interagency heat pump working group composed of representatives from NASA, the U.S. Army, and the U.S. Air Force through which he learned of a hybrid cycle heat pump. He obtained additional funding for the effort and used the SBIR program to put the technology on contract in a timely manner.

This technology, QwikBoost, transitioned from a promising concept to a commercial product in less than three years.

QwikBoost improves performance by effectively increasing the latent heat of the working fluid. A single application of QwikBoost increases cooling performance for the life of the system and reduces wear on the compressor. QwikBoost, which became available for auto air conditioners in early 1998, will debut in home appliances by 2000 and in residential air conditioners by 2003. The product will save consumers 10% to 20% on heating and cooling costs, while saving the nation billions of dollars in energy costs per year.

1998 General Ronald W. Yates Awards for Excellence in Technology Transfer

The General Ronald W. Yates Award for Excellence in Technology Transfer honors General Yate's numerous and lasting contributions to the Air Force Science and Technology Program. As the first Commander of Air Force Materiel Command (AFMC), this award was established as a tribute to his achievements and support of technology transfer. One individual and one team award are presented annually to personnel who work within AFMC and have made significant contributions to technology transfer.

High-Speed Electronic Imaging (Individual Award)

Mr. Donald R. Snyder, U.S. Air Force Research Laboratory Munitions Directorate was awarded the 1998 General Ronald W. Yates Award for Technology Transfer for his outstanding efforts to research, develop, and transfer high speed imaging technologies. The technology for electronic high-speed imaging and high-density storage has become a pervasive underpinning for the aerospace, Defense, and manufacturing community. The ability to convert to online digital high-speed imaging has been estimated to have billions of dollars in impact to the manufacturing community and has provided the technology base for next generation "brilliant" autonomous weapons; bridging the gap from television to scientific sensor with output rates capable of supporting the most challenging instrumentation or scientific applications.

The technology developed for high-speed imaging has spun off at least 10 commercial products with applications in medical imaging for cytology and neurology; automated inspection of advanced semiconductor/computer manufacturing; sports science/ medicine; astronomy; laser radar for collision avoidance; and flow diagnostics for research into advanced supersonic/hypersonic civilian and military aircraft.

Technology transfer to the medical arena includes Henry Ford Hospital adopting a high-speed imaging technology for real-time X-ray imaging of heart and other critical organ motion during airbag-crash testing. Walter Reed Institute of Research has employed technology for laser scanned imagery for precise 3-D mapping of head and dental features for construction of the physical features of military members with head injuries. Commercially, Hoffman-LaRoche and Teledyne Brown are exploiting the technology for high-speed automated inspection of slides for cancer cell detection.

Another current use of this imaging technology is the Naval Research Laboratory In-flight Oil Analysis System for real-time monitoring of particle growth in jet turbine engines which uses imaging technology developed by Mr. Snyder. This system is projected to save millions of dollars in both commercial and military jet engine maintenance costs and provide real-time warning and prediction prior to catastrophic engine failure.

+100 Jet Fuel Thermal Stability Enhancing Additive (Team Award)

The 1998 General Ronald W. Yates Team Award was awarded to Mr. Robert w. Morris and Mr. George Buchhalter Sr. for the Air Force Research Laboratory, Propulsion Directorate for their work on increasing the high temperature thermal stability of jet fuel by 100°F. The additive package acts like a "fuel injector cleaner" to inhibit the formation of gums, varnish, and coke in jet engine fuel injectors, manifolds, and afterburner components. In tests of fighters, trainers, helicopters, and cargo aircraft, the Air Force found reductions in fouling/coking and reductions in the maintenance required to replace and clean the fouled components.

In January of 1998, the Tampa Police Department contacted the Air Force Research Laboratory Propulsion Directorate to determine if the "+100" additive package would work in the jet A fuels used in police helicopters to reduce maintenance. The Tampa Police Department has been cleaning fuel nozzles weekly (approximately every 35 hours) and the Hillsborough Sheriffs Department cleans nozzles every 100 hours to allow uninterrupted use of their helicopters.

The team of Mr. Morris and Mr. Buchhalter coordinated with the police departments, Allison Engine Company, BetzDearborn (additive manufacturer), and Hammond (manufacturer of additive injection equipment) to contact and evaluate the additive. The goal of this effort was to extend the cleaning interval from less than 100 flight hours (weekly) to as many flight hours as possible before cleaning.

Since late January 1998, the Tampa Police Department has been able to increase the time between cleaning fuel nozzles from 35 hours to over 70 hours and Hillsborough has not had to clean a fuel nozzle for approximately 1000 flight hours. In addition, during this time no helicopter has experienced a reduction in power during flight, a major problem associated with fouled nozzles. The police department expects to save several thousand dollars per year by avoiding maintenance manhours and reducing the number of replacement parts. As an added benefit, the engine combustor hardware and engine exhaust appear to be cleaner with less smoke and soot being released into the atmosphere. The Air Force will realize a reduction in the cost of the additive as a result of the increased economy of scale in the production of the additive.

Office of Technology Transfer for Education (OTTE)

The Office of Technology Transfer for Education (OTTE) manages education outreach activities for and is jointly funded by the Air Force Research Laboratory/Space Vehicles Directorate (AFRL/VS) and AFRL/Directed Energy Directorate (AFRL/DE). The local neighborhood of OTTE is the State of New Mexico and surrounding areas.

The basic philosophy of OTTE is to foster and encourage partnerships which leverage resources, capabilities, and talents of schools and other education outreach providers. This list includes the Professional Aerospace Contractors Associations (PACA), Challenger Center for Space Science Education, New Mexico Technet Inc., Mathematics, Engineering and Science Achievement (MESA), NASA, Sandia National Laboratories, New Mexico Department of Education, New Mexico Tech, and other Federal and state agencies.

Within the OTTE model, AFRL provides mentors, equipment, access to technology, and training for teachers. Schools provide the expertise in teaching, classroom management, and long range educational goals and objectives.

Applications are encouraged from applicable schools through the State of New Mexico and surrounding areas. This includes participation by private schools and home school associations. OTTE also strives for the fullest participation by all students, including students with special needs, and students in alternative schools settings, such as Homebound and School on Wheels.

In FY 95, OTTE added an education component for elementary school students called Marsville®. Marsville® was developed by the Challenger Center for Space Science Education and was chosen because of its close tie into the laboratory's space technologies. Marsville® was piloted in the greater Albuquerque area with inclusion of two schools from Clovis, NM. In FY 96, OTTE began planning for state-wide expansion of Marsville®. In FY 98, Senator Domenici requested that the laboratory develop a program which would, through technology-based tours and mentoring, encourage middle school students who do not see themselves pursuing careers in mathematics, science or engineering to consider such careers. In collaboration with Albuquerque Public Schools, OTTE designed the Providing Engineering and Technology Experiences for Students (PETES) project. The PETES concept calls for developing these students as mentors for younger students and integrates character education philosophy into the process.

Through the efforts of Senator Domenici's office, in FY 98, partial funding of PETES and Marsville® was provided by NASA through the NM Space Grant Consortium. This funding was used to help offset costs for development of the PETES pilot project (FY 98 and FY 99) and expansion into one rural link-up site in FY 98 and three rural link-up sites in FY 99.

In FY 99, the number of schools participating in OTTE projects has significantly increased. The number of Marsville® schools increased by 130% from 18 in FY 98 to 39 in FY 99 and included the addition of three link-up sites at rural locations. At the Carlsbad Link-Up Site, the Mayor of Carlsbad read a proclamation declaring that day, April 8 1999, to be the Air Force Research Laboratory Phillips Research Site Day.

The Alliance for Photonic Technology (APT)

The Alliance for Photonic Technology (APT), is a partnership formed by the Los Alamos National Laboratory, Sandia National Laboratories, the University of New Mexico's Center for High Technology Materials, and the Air Force Research Laboratory – Phillips Research Site to enhance the global competitiveness of U.S. industry in the critical technology area of photonics by accelerating transfer of federally funded technology developed by APT's R&D participants to industry. APT's mission is to strengthen photonic technology related to products, markets, and services by working in partnership with U.S. industry to create a competitive advantage in the world market place. By leveraging the world-class photonic technology base of the R&D partners, APT facilitates collaborative research, development, and technical assistance with its industry partners. During FY 99, APT continued to support the New Mexico Industry Association (NMOIA) Cluster which connects some 50 optics and photonics companies within the state.

APT facilitated the successful partnership between Indigo Medical, Inc. and the APT R&D partner that led to the implementation of a new medical procedure. Through a CRADA, the Air Force Research Laboratory, Sandia National Laboratories, Los Alamos National Laboratory, and the private firm of Indigo Medical Inc. produced a unique laser system that offers an alternative to America's most prevalent in-patient surgery – the correction of benign prostate enlargement.

All Composite Truck Box

The Automotive Composites Consortium under the umbrella of USCAR (a consortium of Ford, General Motors, Chrysler, and the Department of Energy) has contracted with the National Composite Center (NCC) to develop the manufacturing process that will allow the economical production of an all composite pick up box. The major goal is for the composite structure to be cost competitive with the welded steel structure it replaces.

The NCC was a catalyst for the successful transfer of technology between the government and private industry. This technology transfer is an example of "spin-on" from the USCAR sponsored pick up box program that is utilizing a proprietary glass fiber preform process. The Air Force is building upon the technology developed for the pick up box and expanding it into stronger carbon fiber technology. The USCAR program will benefit the Air Force project as they seek to develop cost effective carbon structures.

This composite truck box is currently in production and will replace the old steel pick up bed and liner. The box is made from fiberglass/polyurethane, is 30% lighter than conventional steel plus liner, is cost competitive, takes 4 minutes to produce preform robotically, takes 4 minutes to infuse, and is sponsored by the big three U.S. automotive makers.

Forced Air Aircraft Deicing

The Air Force Research Laboratory Air Vehicles Directorate (AFRL/VA) and Aviation Environmental Compliance Inc. entered into a CRADA to investigate using a high speed jet to blow snow and ice from aircraft wings. The Air Force received a more efficient deicing system which reduces glycol usage by 70-90% and reduces deicing time by 50%. The industry partner received an improved, less expensive, and more efficient air delivery line configuration and a more effective nozzle.

Electro-Optic Tunnel Gauge

Measuring the inside diameter of tubes and holes has often been expensive and requires frequent and costly recalibration. The Air Force Research Laboratory Sensors Directorate under a CRADA with Gauge & Measurement Technologies, Ltd. (GMT) of Dayton, Ohio, developed a laser based device called the Tunnel Gauge for measuring interior dimensions of tubular or hollow structures. A broad range of tubular structures from several feet in diameter to less than one inch in diameter with accuracy to 0.002 inch.

Ohio produces more tubing and extrusions than any other state in the U.S. An estimated $20 million market for this device is anticipated over the next four to five years. This device allows for more accurate tubing with less scrap and rework resulting in lower costs.

CRADA Between Nichols Research Corporation and the Munitions Directorate

A CRADA was established between Nichols Research Corporation and the Air Force Research Laboratory Munitions Directorate (AFRL/MN) in FY 96. The objective for this ongoing agreement is to advance the technical scope and public and/or private awareness and use of the government-sponsored Irma Model. Nichols and AFRL/MN will benefit from the continued private use of the now Multi-sensor Modeling and Analysis Irma Model. Through this CRADA, AFRL/MN has been able to extend information on the

enhanced Infrared Modeling and Simulation Code to a wide user group through a unique educational method. Nichols Research has been instrumental in formulating course materials and presenting training classes to a wide user base. The CRADA was initially written for 36 months, but is being extended to 48 months to allow for additional training sessions.

Munitions Directorate Patents

The Air Force Research Laboratory Munitions Directorate in partnership with Gulf Coast Alliance actively marketed two patented AFRL/MN technologies in FY 99.

Tape Type Microstrip Patch Antenna

Microstrip antennas are conventionally fabricated from printed circuit board materials. These antennas cannot be manufactured in mass production for low cost, and they cannot be quickly and easily mounted on different types of non-planar surfaces and are subject to failure from flexing. This invention provides an antenna which is simple and easily adaptable to various mounting conditions. The antenna is omnidirectional and can easily be attached with structural tape adhesives to munitions ranging in size from a baseball to the size of 2000 lb. munitions. It is able to withstand severe environmental conditions including temperature, wind, forces, and vibration. The concept of the peel and stick antenna was a spin-off of the subminiature telemetry program.

Wide Bandwidth Microstrip Patch Antenna

Conventional printed antennas use thin films of good conductors such as copper and gold which are deposited, printed or etched onto thin, low loss dielectric substrates, which are usually backed by another good conductor. This disadvantage of currently available microstrip patch antennas is their narrow radiation bandwidth. This invention provides a microstrip patch antenna, which substantially increases the bandwidth of the antenna by modifying the region near the radiating edges of a conventional patch shape with dielectric overlay strips attached along the edges of the patch and onto the substrate. The resultant sandwich structure forms a highly flexible, low profile, low cost, rugged conformal antenna which can be dispensed from a roll of generic patch antenna devices. After testing, the antenna can easily be removed with a solvent. Possible applications include machinery status monitoring, instrumentation, logistics and supply monitoring, remote control, and environmental monitoring.

Low-Cost Advanced Instrument Controller

Management Sciences, Inc.

The Air Force Research Laboratory Space Vehicles Directorate and Management Sciences, Inc. have joined together in a CRADA to conduct research and development of low-cost Advanced Instrument Controller (AIC) microsystems. This CRADA addresses the development and application of lower cost AIC systems for widespread application within the government and industry.

Reducing the cost of AICs make them attractive for use in a wide variety of military applications. Preliminary work has identified potential applications ranging from shipping containers to helicopters. It provides the ability to infuse processing into many locations within a system that was previously impossible. Such insertion makes autonomous systems much more capable, and reduces ten- to hundred-fold the size, weight, and power necessary to do ordinary functions of data acquisition and intra-platform communication. Many new possibilities in smart systems will exist through the advent of the AIC. Lower cost versions of AIC improve the affordability of the basic AIC capability.

Interaction with a wider application base serves to provide a wealth of information for further improvements to the AIC. One such example is the ability of the AIC to operate directly from JAVA language specifications. The forces that drive AIC interest in aerospace and commercial applications permit useful refinements, consistent with the dual-use model.

Pressure Infiltration Casting May Revolutionize Manufacturing Processes

A manufacturing technology effort supported by the Air Force Research Laboratory Materials and Manufacturing Directorate, working with Metal Matrix Cast Composites (MMCC), Inc., has resulted in the successful development of a manufacturing process that could help revolutionize and mature metal composite parts fabrication. The "Advanced Pressure Infiltration Casting Process" (APIC™) developed by MMCC, Inc., allows computer-aided-design (CAD) drawings to be turned into high quality finished products in a matter of days. The process expands rapid prototyping to where new design concepts demanding lightweight, low profile, stiffer materials can be quickly manufactured and evaluated. Durable parts for engines and brakes can be manufactured with a longer life, at just half the weight and at much lower cost. The APIC™ process has also extended its capabilities to serve the national defense, space, and supporting industries such as telecommunication space satellites, aerospace electronic devices, and military armor.

The current market demand for developing complex vehicles in less time at reduced costs, with an emphasis on increased performance, high quality, and safety, has created major challenges for designers, engineers and manufacturers. One impact has been an increasing trend in the aerospace and Defense industries towards reducing the cost of parts manufacturing, even in low production volumes, while producing components that weigh less and are of technically superior quality. The trend is especially noticeable in the composites manufacturing sector, where non-recurring expenses such as prototype design, tooling, and production can be very high. Conventional approaches to part development are being replaced with emerging net shape rapid prototyping technologies.

A manufacturing technology effort supported by the Air Force Research Laboratory's Materials and Manufacturing Directorate, working with MMCC, Inc., has led to expanded successful development of MMCC's APIC™ process which achieves uniform dispersal of particles and incorporates selective tailoring of the part being cast. Unlike conventional casting processes, APIC™ has the ability to reinforce a multitude of aluminum and copper alloys with many types of materials and architectures, which produce a broad range of choices for designers and engineers. APIC™ related research and development is also being supported by the Navy, the Defense Advanced Research Projects Agency (DARPA), and the National Air and Space Administration (NASA). Current and prospective applications include connecting rods for two-stroke outboard marine engines, brake calipers, water-cooled brake discs for heavy trucks working stop-and-go routes, and aircraft tow vehicles, brake caliper pistons, brake rotors and circuit board heat sinks. APIC™ has also been used to fabricate push rods and racing bicycle pedal cranks. APIC™-fabricated components are about half the weight of the components they replace, which means they're increasingly useful in the quest for lowered operating costs.

The APIC™ process offers a highly effective means for developing cost-competitive, metal matrix composite products that can be used to replace steel and other high-density materials.

1-800-203-6451

The Air Force Technology Management Team manages the Air Force "Tech Connect" service (1-800-203-6451). Tech Connect receives telephone and e-mail inquiries from potential outside partners and searches for the Air Force technical experts in the laboratories and centers who can best answer the customer's technical questions. This coming year Tech Connect will continue to expand and improve its network of Air Force technical contact points. The Air Force Technology Transfer Management Team will work with the technology transfer focal points in developing and implementing technical assessment methodologies to proactively focus their transfer activities to target industry (i.e. medical, automotive, assistive technologies, etc.).

Intellectual Property Management Information System (IPMIS)

The Air Force implemented the Intellectual Property Management Information System (IPMIS) in coordination with the Navy who initiated development of the system. The system has been installed at five Air Force sites where input from the field is being collected to further refine the system. IPMIS will provide the Air Force with an improved method of managing and tracking patent activity at the local level.

Defense Advanced Research Project Agency

DARPA's Unconventional Pathogen Countermeasures Program

The Unconventional Pathogen Countermeasures (UPC) Program within DARPA has the primary goal to develop novel, broad-spectrum countermeasures against bacterial and viral pathogens and toxins that are versatile enough to eliminate both known and unknown biological threat agents, whether from natural or engineered sources. This program promotes the development of cutting-edge technologies that industry may otherwise not pursue due to their high-risk nature.

DARPA-funded UPC projects must progress through a rigorous process where the technologies are matured to the point where their chances of achieving Food and Drug Administration (FDA) approval is significantly higher than other high-risk technologies being developed in industry. In the past, FDA clinical trials typically took 5-15 years to complete. Currently, clinical trials take 1.5-5 years, which is a significant improvement. During the clinical trial and approval period, industry funded projects generally have a success rate of 1%, while it is projected that the DARPA/UPC projects will have a 50% success rate. The relatively high DARPA/UPC success rate can be attributed to the defined "funnel" or path a project takes from initial research to being transitioned for FDA approval. Once the FDA approves a technology, it can be transitioned for further development to a Department of Defense laboratory, pharmaceutical company, biotechnology company, or national laboratory/institute.

Dr. James Baker, with the University of Michigan and a Principal Investigator in the UPC program, has developed a composite material that will serve as a pathogen avoidance barrier and post-exposure therapeutic agent that is to be applied in a topical

manner to the skin and mucous membranes. Under this program Dr. Baker patented this topical lotion that effectively kills anthrax spores. This patented technology is currently being transitioned into the pharmaceutical/biotechnology industry.